THIRTY-SIXTH QUARTO VOLUME

From January 1, 1904, to June 10, 1904

RAILROAD GAZETTE

A JOURNAL OF TRANSPORTATION, ENGINEERING AND RAILROAD NEWS

(Established in April, 1856)

FORTY-NINTH YEAR

NEW YORK - - 83 FULTON STREET

1904

RAILROAD GAZETTE

FRIDAY, JANUARY 1, 1904.

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Contributions

Compulsory Block Signaling.

Swissvale, Pa., Dec. 29, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I wish to register a protest against the attempt to empower the Interstate Commerce Commission to compel the use of block signals and interlocking. First, it is probably unconstitutional; second, it is certainly inexpedient. It would be an unwarranted extension of the authority of the Federal Government into the States. It might impose upon many railroads burdens which they should not be compelled to bear, and it would probably lead to the installation of a great deal of cheap and dangerous material.

H. G. PROUT.

The Turning Moments of Four-Cylinder Balanced Compound Locomotives.

New York, Dec. 23, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the December issue of the *American Engineer*, Mr. Edward L. Coster points out two specially important features of balanced compound locomotives. In view of the fact that this type of engine is coming into use in this country, it seems well to point out a serious error in the article, which concerns fundamental principles and which might lead to unfair condemnation of a type of locomotive which is admirably adapted to high speed work. Mr. Coster says in part:

I do not recall any reference having been made to two very important advantages possessed by these engines over the ordinary two crank locomotives, namely (1) the higher value of the normal coefficient of adhesion, and (2) the greater uniformity of the tractive force developed during each revolution of the driving wheels. Since these characteristics of the balanced locomotive have, to a considerable extent, enabled it to regularly perform work in Europe for which in this country an engine of some 20 per cent. greater weight is required, I beg leave to direct special attention to them.

In any two crank locomotive, whether of the single-expansion, 2-cylinder compound, Vauclain, or tandem compound type, the turning moments, as is well known, vary greatly throughout the revolution, attaining their maximum theoretical value when the two cranks are in front of the axle and stand at angles of 45 degs. with horizontal or vertical lines, and decreasing from thence to the dead points, where the rotative effort falls to a minimum.

With a locomotive having four cranks set at 90 degs. to each other, the turning moments are, obviously, much more uniform than in an ordinary engine, and practically approximate very closely to the results obtained from an electric motor drive.

The cranks of a four-cylinder compound locomotive are not set "at 90 degs. to each other" and the tractive force developed during each revolution of the driving wheel is not more uniform in the four-cylinder balanced compound than in the ordinary two cylinder engine. The diagram, Fig. 1, shows the arrangement of the cranks and cylinders of the four-cylinder balanced compounds built by the Baldwin Locomotive Works, for the Santa Fe. The high pressure cylinders are inside the frames and connect to the cranked axle of the first pair of drivers. The low pressure cylinders are outside the frames and connect to crank pins on the forward drivers. The cranks of the two high pressure cylinders are set at 90 degs. to each other and the cranks of the two low pressure cylinders are set at 90 degs. to each other. The cranks of the high and low pressure cylinders on one side are, however, not at right angles to each other, but are directly in line. This arrangement is a modification of the de Glehn design which was first introduced on the Northern of France in 1885. In the de Glehn type the low pressure cylinders are inside the frames and the high

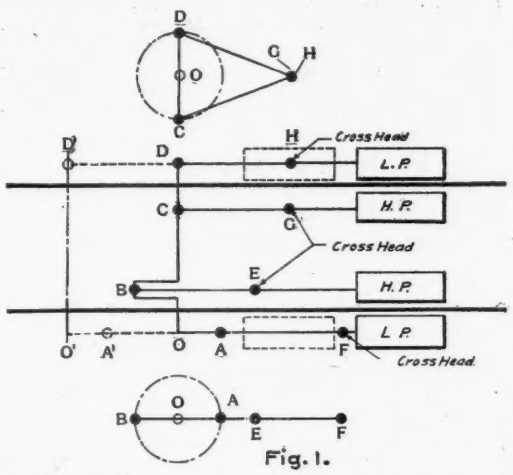


Fig. 1.

Arrangement of Cylinders and Cranks of de Glehn and Santa Fe Four Cylinder Balanced Compound Locomotives.

pressure cylinders are outside the frames. The low pressure cylinders are side by side and drive inside cranks set quartering on the forward driving axles. The high pressure cylinders connect with outside cranks in the drivers of the second driving axle as shown by the dotted lines in Fig. 1. These cylinders are not in the same cross section with the low pressure cylinders but are carried back on the frame a distance, which is about equal to the spacing of the driving axles, so that the main rod which connects an outside cylinder with the second driving axle will be no longer than the main rod of an inside cylinder which connects with the first driving axle. This arrangement affects in no way, however, the relation of the cranks as explained above.

The diagram, Fig. 3, shows the variation of the tractive effort of the Santa Fe four-cylinder compounds when running at 30 miles an hour. These engines have 15 in. and 25 in. x 26 in. cylinders and the drivers are 73 in. in diameter. The horizontal scale of the diagram gives the angular positions of one of the high pressure cranks, the tractive effort of each of the cylinders being calculated at its corresponding position and the sum of the tractive efforts being then added together. The diagram shows that the tractive effort at 30 miles an hour varies from about 9,500 lbs. to 13,500 lbs. The diagram, Fig. 2, shows the method used in calculating the tractive efforts. The crank and connecting rod are laid off to scale and the effective pressures in the high and low pressure cylinders at the several positions of the crank are measured as shown on the indicator diagrams. The effective pressure multiplied by the piston area in each case gives the total pressure on the cylinder. The component pressure along the connecting rod is next determined by a triangle of forces and the tangential effort at the crank pin is then formed by constructing another force diagram at the crank pin. This tangential force multiplied by the ratio of the crank diameter to the driving wheel diameter gives the equivalent tractive effort. For example, when one of the low pressure cranks is at 90 degs. (vertical) the mean pressure in the cylinder is 29 lbs. per sq. in. Multiplying this figure by 490 (the area of the low pressure cylinder) gives 14,200 lbs. as the total pressure exerted by the cylinder. The force diagrams are then constructed as shown on the diagram. In the calculations, it has been assumed that the cards from each corresponding cylinder are identical. The following table shows the tractive efforts developed by each cylinder at the several positions of the right hand high pressure crank. The sum of the tractive efforts at each position gives the total tractive effort developed at each position as shown by Fig. 3.

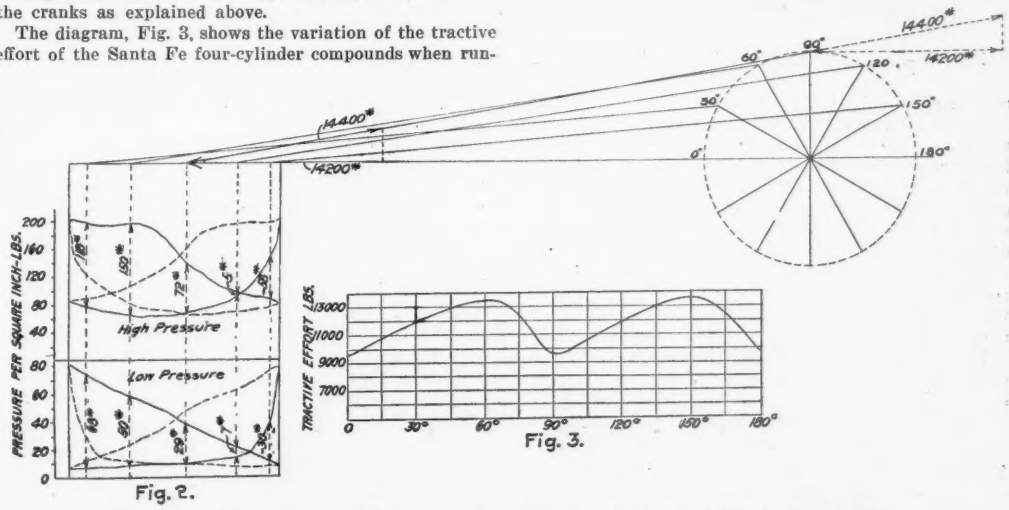


Fig. 2. Fig. 3.

Variation of the Tractive Effort of the Santa Fe Four Cylinder Balanced Compounds.

Tractive Efforts of Cylinders of Santa Fe Four-Cylinder Compounds.

Position of right H.P. crank, degs.	Right side. H.P. cyl., lbs.	Right side. L.P.cyl., lbs.	Left side. H.P. cyl. lbs.	Left side. L.P. cyl., lbs.	Total lbs.
0	0	0	4,520	5,019	9,539
30	4,200	6,690	250	925	12,065
60	9,200	8,081	—1,602	—2,278	13,401
90	4,520	5,019	0	0	9,539
120	250	925	4,200	6,690	12,065
150	—1,602	—2,278	9,200	8,081	13,401
180	0	0	4,520	5,019	9,539

The tractive effort at certain points of the stroke of each cylinder has a negative sign. This is due to the compression which exerts a pressure against the direction of motion of the cylinder and crank pin.

The chief advantage of the four-cylinder compound, over other types of compounds lies in the fact that the reciprocating parts on each side can be almost exactly balanced. This not only makes a smooth running engine but also relieves the track from the severe "hammer blow" at high speeds.

Q. E. D.

The Arnold Electro-Pneumatic Railway System.

TO THE EDITOR OF THE RAILROAD GAZETTE:

As many of your readers know, I have persistently advocated the use of the alternating current directly in the motors for electric railways for several years (see Transactions American Institute of Electrical Engineers joint meeting with the British Institution of Electrical Engineers, Paris, Aug. 16, 1900; Niagara Falls Convention, Aug. 24, 1901; Great Barrington, Mass., June 19, 1902, and New York, Sept. 26, 1902). By referring to the discussions which took place at these meetings, and to the technical papers, it will be found that there were until recently, few, if any other advocates, in this country, of the alternating current motor for railroad work, and that those who supported it abroad advocated the use of three-phase currents until within the last few months. Since my announcement of the principles of my system before the Great Barrington convention, the development of the single-phase alternating current railroad motor has made remarkable strides, both in this country and abroad, and while at that time it had few friends, the development has been such since, that it now seems destined to take its place as the leading railroad motor, thereby effecting a revolution in electric railroad work.

I had hoped to be able to celebrate the incoming of the year 1904, with a public demonstration, on 20 miles of railroad, which would conclusively prove that the single-phase electric railroad is not only operative but efficient and less in first cost and operation than any system now in vogue, not meaning to imply thereby that the system which I have developed was necessarily the only system or the best system, but that it was a system which would successfully do the work, and the system which was first developed and first to be put in actual operation upon the first electric railroad in the world especially built for single-phase alternating current motor operation.

That I would have made a demonstration on January 1, was a certainty to me, until December 18, when the car barns of the road upon which I had been experimenting, located at Lansing, Mich., were completely consumed by fire. The fire destroyed a steam locomotive and two new cars built for my system, as well as my experimental locomotive, thus leaving me unable to make the demonstration as I had planned.

On April 23, 1900, I undertook to build and equip a road from Lansing to St. Louis, Michigan, about 60 miles. Engineers were at once placed in the field to locate it, and after the plans were sufficiently completed, the grading, bridging and track work of 20 miles of the road followed, and this much of the road was completed, to such an extent, that steam trains were put in regular operation over it about Nov. 15, 1901.

The work progressed rapidly and the overhead and line work of 20 miles of road was practically completed and ready for operation about Dec. 15, 1902, and the power

installed so that experiments began in March, 1903. On June 15, 1903, two trips were made, each about three miles long, with my first experimental machine. On the first trip seven persons were carried and on the second trip 13 persons were aboard.

The result of the experiments with the first motor proved the correctness of the theory and that the machine would work. Inasmuch as it consisted of but one, somewhat crude, electro-pneumatic motor, it was impracticable to get full and efficient tests of the system, and it was thought best to conduct no further experiments until a complete new double equipped truck could be perfected. Not being connected with manufacturing establishments I have been compelled to develop this system under trying circumstances, necessitating the construction of parts in different shops and assembling them at far distant points with crude facilities. This fact, combined with the financial difficulties that have arisen, and the necessity of my having to give the main part of my attention to other matters, have been the causes of the delay in completing the road and the system.

A new double motor equipment, in the form of a locomotive, was finally built and brought to perfect working condition on the evening of December 17, and it was this locomotive with the necessary instruments for testing purposes that was destroyed by fire, the following morning. Since it is impracticable for me to get a new one constructed for some time, I have thought best to state the facts as outlined above, and give a description of the apparatus and the road, reluctantly omitting the records of operation and the tests which I had hoped to have accompany any future statements I made, but which through "the irony of fate" must now be left for the future.

I hand you, herewith, a hastily prepared description of the road and the system, which I trust will be found sufficiently comprehensive to interest your readers.

BION J. ARNOLD.

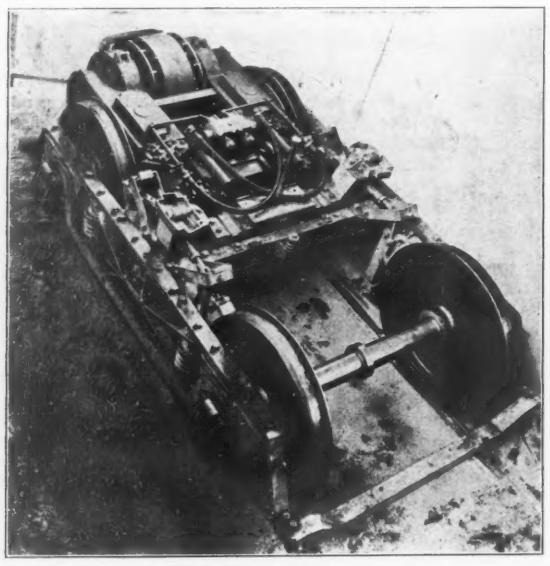


Fig. 5.—First Experimental Motor Truck with Motor in Rear.

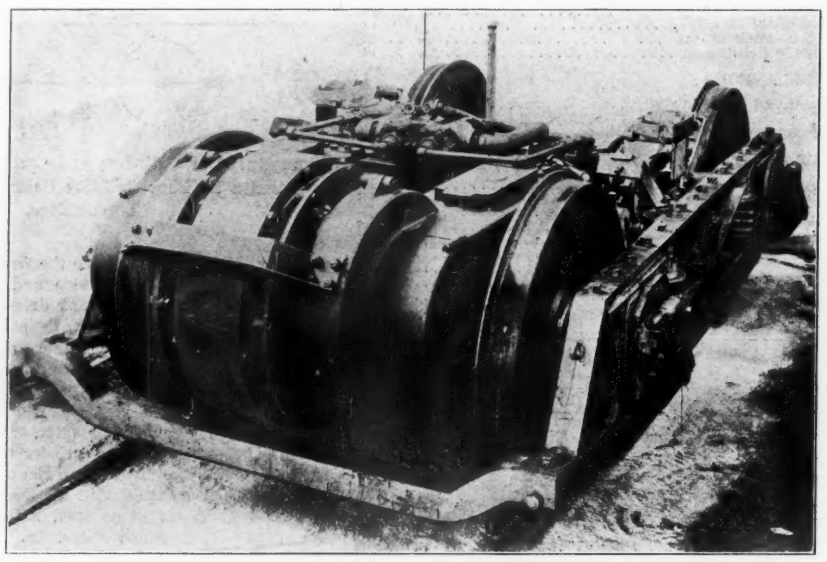


Fig. 6.—First Experimental Motor Truck with Motor Forward.

The Arnold Electro-Pneumatic Railway System on the Lansing, St. Johns & St. Louis Railway.

Roadbed and Track.—The Lansing, St. Johns & St. Louis Railway was originally projected to extend from Lansing, the capital of Michigan, northward through St. Johns, Alma, and St. Louis, a distance of about 60 miles, but up to the present time only that portion extending from Lansing to St. Johns, 20 miles, has been constructed. This road was built in accordance with steam railroad practice, with easy grades and curves, so that steam locomotives could be operated over it until such time as electrical equipment could be put upon it; the idea being to complete the road in such a manner that it could be utilized for both freight and passenger service, and thus secure all the business available from the territory through which it passes.

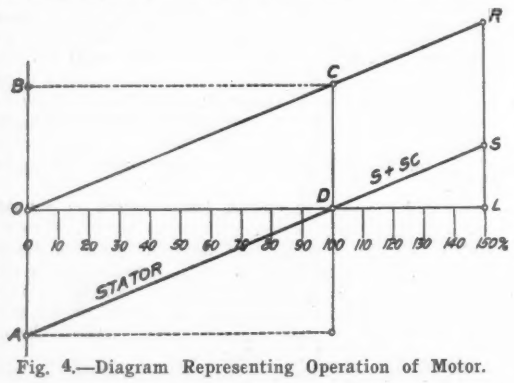


Fig. 4.—Diagram Representing Operation of Motor.

The road is equipped with 67-lb. T-rail, laid on ties spaced 2 ft. apart between centers, and as alternating high tension current was to be used, but one of these rails was bonded with 38-in., ⅛ bonds extending entirely around the splice bars. Since it was impossible to secure rails from the rail manufacturers in time, rails and splice bars were secured from one of the leading steam railroads, and this necessitated the adoption of a supported joint and a long bond, as there was not room under the splice bars for concealed bonds.

The road as at present constructed between Lansing and St. Johns has no grades exceeding 1 per cent. and no curves exceeding 7 deg., except in the cities themselves, where the terminals of the road run over the streets and make such curves as ordinary street cars make, the minimum radius being 50 ft. At each city a terminal was planned so that all freight would be diverted to connecting steam roads, thus making it unnecessary for the freight service to pass over the city streets or curves. At the Lansing end it was necessary to pass over the tracks of the Pere Marquette, and this necessitated the construction of a bridge, with pile approaches; the grade as approached from the Lansing end being 4 per cent. for a distance of about 700 ft., and after passing over the bridge the descending grade is 2.3 per cent. for about 500 ft. At the St. Johns end there is a grade on the principal street of the town averaging about 2 per cent. for about 1,500 ft.

Overhead Construction.—Considerable care was taken in planning a suitable insulator for carrying the trolley wire, and an annealed glass insulator of special design was used. Fig. 1 shows a typical arrangement of the straight line overhead construction, and it will be noticed that wood is used for the pole, cross arm and brace, and that the insulator is supported by means of a short span wire from iron brackets secured to the wooden cross arm. This construction insured a high insulation at a low first cost, the entire line having been constructed for but a slightly increased expense over the cost of standard construction, and at the same time was so built that in case of failure of the alternating motor system the standard direct current motor system could be put into service without changing any parts, even holes for the pins for carrying the extra feeders which would be required were provided, as shown.

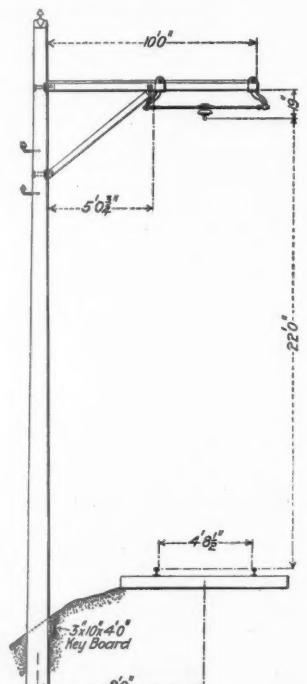


Fig. 1.—Detail of Overhead Construction.

The working conductor was placed 22 ft. above the top of the rails in order that trainmen when standing upon the tops of the freight cars going over the road could not come in contact with the working conductor.

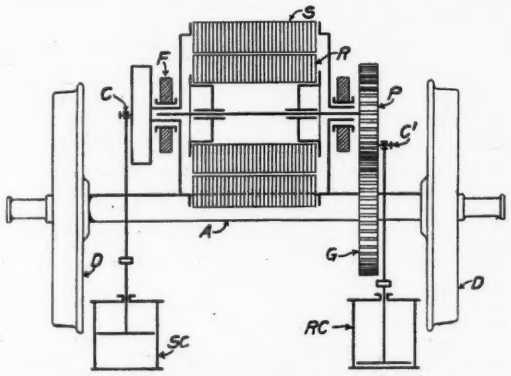
It was planned to operate the entire road from a single ⅜ trolley wire and with one rail bonded, this amount of copper being sufficient to operate four 40-ton cars at an average speed of 30 m.p.h. with power house located 1½ miles from one end of the line, and operating with from 6,000 to 10,000 volts on the working conductor. The power house is located at one end of the line, owing to the fact that the electric company, from which power is purchased by the railroad, has a water power station at this point. Current is transmitted to the nearest end of the line over two No. 3 wires. The power is furnished from a 300 k.w. rotary converter generating at 380 volts, at 25 cycles, the energy from which is stepped up to the working pressure of the line. It was the intention, after experimenting a sufficient length of time to determine the best voltage for the working conductor, to have the generators for the permanent plant constructed so as to generate at this determined voltage, and it was for this reason that a temporary rotary converter was first installed with which to conduct the experiments. During the preliminary experimental period upon the apparatus, all power was transmitted from the power house to a point about two miles distant, where were located the car barns in which the preliminary experiments were made.

The principles on which the system is based were stated by Mr. Arnold in a paper read before the A. I. E. E. at the Great Barrington convention on June 19, 1902. An abstract of this paper was printed in the *Railroad Gazette*, June 27, 1902, p. 506, and the reader is referred back to that issue.

By the adoption of this system it is claimed that the following results will be accomplished:

First.—The entire elimination of the present standard system of rotary converter, sub-station plant, together with the maintenance thereon, and the cost of the necessary attendance.

Second.—The absorbing and rendering available for useful work in starting, or otherwise, a large percentage of the energy stored in the moving mass which under the present methods of operation is dissipated at the brake-shoes.



R=Rotor. S=Stator. F=Frame. P=Pinion on Rotor. G=Gear on Car Axle. A=Axle of the Car. D=Driver of the Car. RC=Rotor Cylinder. SC=Stator Cylinder. C=Crank of Stator. C'=Crank of Rotor.

Fig. 3.—Diagrammatic Arrangement of Electro-Pneumatic Motor.

Third.—A large reduction in the first cost of electrically equipping long distance railroads, thereby making it feasible, from an engineering and business standpoint, to equip many roads which cannot now be shown to be advisable, thus opening up the steam railroad field to the industry in which we are now engaged.

The following description explains in detail the appli-

cation of the principles of the system and the mechanism of its working parts:

Fig. 3 represents diagrammatically the working parts of one form of the system: The rotor R, of a single phase induction motor is geared to the axle of the car and by means of crank pin C', secured in pinion P, also drives the compressor cylinder R. C., while stator S, can freely revolve around the rotor and drive by means of crank pin C, the compressor cylinder S C. Both cylinders are piped to air reservoirs located under the car and are also provided with suitable valves manipulated from a single controller on the car platform for making them perform their various functions; thus the entire regulation of the speed and power of the car is controlled by the air cylinders and no other regulating devices are necessary. The cylinder valves are electrically operated, which makes it possible for each cylinder when driven by the electric motor to compress air into the tanks, and when operated by compressed air to furnish mechanical energy for moving the car. When, for instance, the cylinder is compressing air the valves work like inlet and outlet poppet valves of a common air pump, while on the other hand if the cylinders are supplied with compressed air each valve is operated electrically by a pilot solenoid connected with the valve seat in such a manner that the energy for moving the valve is supplied by the compressed air, thereby making the valve practically self-actuating. The time of operation of the valves is controlled by a series of collector rings revolving with the engine shaft, and their regular operation is interrupted and varied to suit the requirements by means of the motorman's controller.

When a rotary or turbine type of air engine is used, all of the above valves and reciprocating parts are eliminated and the entire controlling mechanism consists of two air valves operated from a single engineer's valve which may be located upon the platform of the car or in the cab of the locomotive, and so arranged that one or more units may be operated from the platform or cab of any unit without the necessity of connecting wires between the units.

Since the motor may be of the simplest type of induction motor, without a commutator, and the system does not require the manipulation or breaking of the main current, the motor may be designed for any working voltage and be of any type which will maintain a constant speed when provided with a constant load. This eliminates the necessity of all step-down transformers, resistances or other regulating devices, and confines the current to the motors themselves, and as these are below the car floor the danger from the current is reduced to the minimum.

At the same time the air cylinders, in addition to performing all the functions of speed control, give to the machine the independent unit element, and the ability to store the kinetic energy of the train in stopping and utilize it in starting. On account of these and other features the electric motors of this system can be much smaller in capacity, when rated as continuous working motors, than those of other systems not possessing this equalizing load feature, and the capacity of the power house and line can be reduced to about one-half of what would be required with systems where the fluctuating starting loads of the cars are transmitted back to the power house.

In order to better understand the different operations of the system, Fig. 4, showing a speed diagram, has been prepared, in which on the axis of abscisse O D L, are represented the different car speeds in per cent. of the synchronous motor speed, while the co-ordinate axis A O B represents the rotor and stator speeds corresponding to the car speeds shown.

The operation of the car may be divided into the following periods:

Standing in the Station.—Referring to Fig. 3 the rotor R, is standing still, while the stator S, runs with full synchronous speed. The stator is then transferring the full energy of the electric motor through crank C, to the compressor cylinder S C, which energy is being delivered in the form of compressed air into the air reservoir. Since the relative velocity between the stator and the rotor is, under all conditions of operation, constant, the speed curves of stator and rotor may be represented by two parallel lines O C R, and A D S, in Fig. 4. The origin O, of the given co-ordinate system represents the period of rest of the car, and, therefore, indicates zero rotor speed and full stator speed in a negative or downward direction, as the stator is now revolving in the opposite direction from that which the rotor must revolve to drive the car forward.

Let it be further assumed that for an instant, O A equals the active torque of the stator, then it will be easily understood that O B, which equals O A, represents the reactive torque of the rotor exerted on the car axle, meaning that if the car is free to move the reactive torque can be used advantageously for the starting and acceleration of the car.

When the car is standing in a station it is held at rest by moving the controller to such a position that the outlet pipe from rotor cylinder R C, is throttled, thereby increasing the pressure behind the piston to such an extent that it overcomes the effort of the rotor R, to revolve, thus tending to cause the stator S, to revolve and at the same time holds the car at rest without the use of wheel brakes.

Starting and Accelerating.—To start the car the air cushion behind the piston of R C, is removed and the air which is being compressed by cylinder S C, supple-

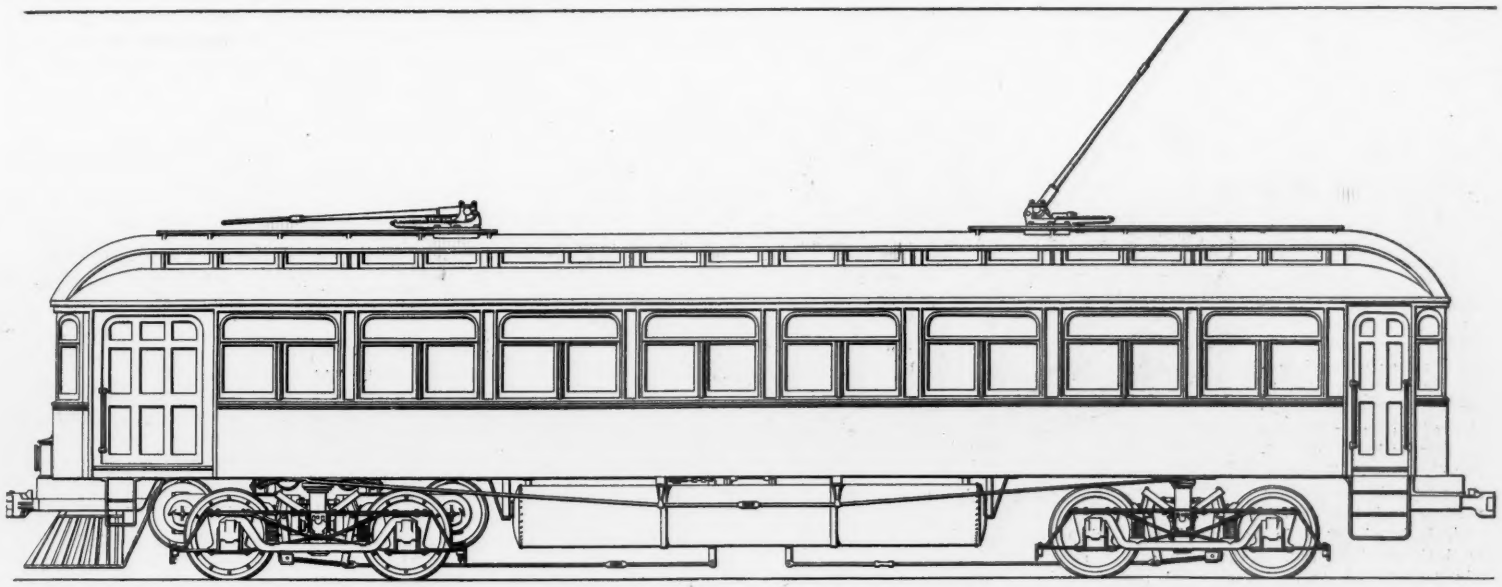


Fig. 2.—Side Elevation of Car with One Motor Truck, Showing Storage Tanks for Compressed Air Under Car.

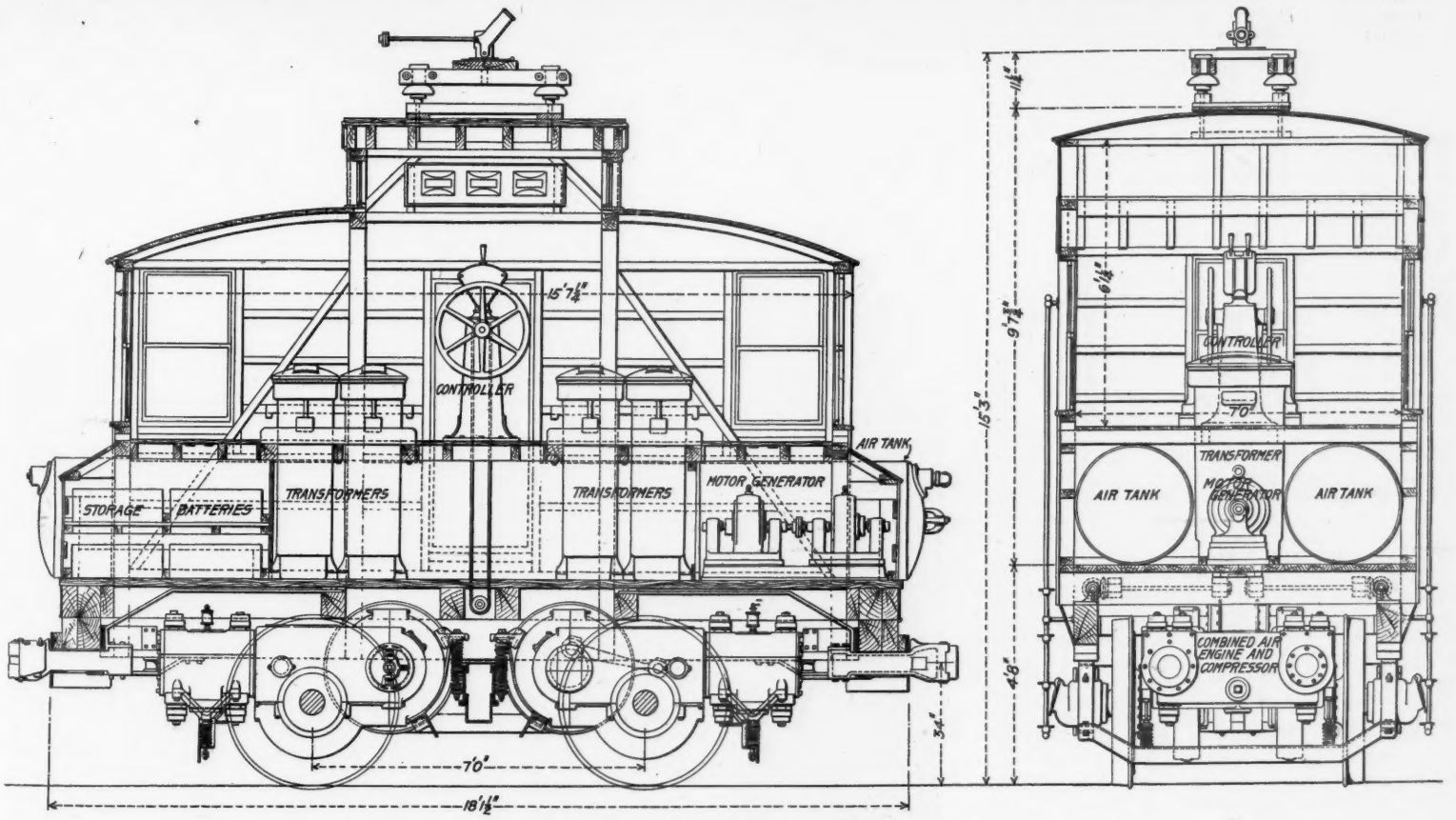


Fig. 7.—Arnold Electro-Pneumatic, Single-Phase Locomotive.

mented by the stored air from the tanks, is admitted to cylinder R C, with the controller at the position of maximum cut-off. The rotor then begins to revolve and as it accelerates the stator slows down by exactly the same amount that the rotor has increased its speed, and as the rotor and car speed increase the controller is gradually moved to a smaller percentage of cut-off until the car speed corresponds to the full synchronous speed of the motor, at which time the stator comes to rest.

During this period of acceleration the air compressed by cylinder S C, instead of being delivered to the tanks to lose its heat, is delivered, hot, directly to the rotor cylinders, thus greatly increasing the efficiency of the combination, as the heat usually lost in air systems is utilized and the advantages of heated air gained without a re-heater, and as the pressure used is low, many of the ordinary difficulties in the use of compressed air disappear. If the rate of acceleration is such that cylinder R C uses all of the air supplied by cylinder S C, no exhaust to the atmosphere from cylinder R C takes place.

Referring to Fig. 4, which graphically represents this process, since the electric motor runs always at a constant speed and a constant load it has a constant torque, and, therefore, the distance between lines O C R, and A D S, may be considered as representing the energy delivered by the electric motor. The length of any ordinate extending from O D to O C, represents the proportionate amount of energy derived from the electric motor which is applied directly through pinion P, and gear G, in Fig. 3, to the propulsion of the car, while the corresponding ordinate extending below O D, to A D, represents the proportionate amount of the energy of the electric motor which is absorbed in compressing air through cylinder S C, which energy, in the form of air, is immediately transferred to cylinder R C and is utilized in accelerating the car. In practice, however, since there will be a loss in transferring the energy from electrical energy to energy in the form of compressed air and back again into mechanical energy, this loss, whatever it may be, must be drawn from the storage tanks, and the requisite amount of air from these tanks supplied to rotor cylinder R C, in order to maintain the full power of the electric motor upon the car axle during the period of acceleration. Should it be desired to accelerate at a greater rate than the full power of the electric motor is capable of giving to the car, the additional energy may be supplied in the form of air from the storage tanks through cylinder R C, thus increasing the total energy given to the car during acceleration, in which case this total power would be represented for any given instant by a point above line B C.

Full Speed.—When the rotor has reached full synchronous speed by the previous operation, this speed can be maintained by moving the controller to another position which will throttle the outlet pipe of cylinder S C, until the reaction due to the pressure behind the piston equals the full capacity of the electric motor. An overload or under-load may be placed upon the motor by varying this pressure, but under normal conditions of operation cylinder S C is provided with an automatic valve which keeps a constant pressure behind its piston, thus maintaining an absolutely constant load upon the electric motor and consequently a uniform demand of electrical energy from the line. This uniform load is represented by the parallel lines O C R and A D S of Fig. 4.

With the controller set at full speed position the inlet valves of rotor cylinder R C are held open and the piston runs free and the electric motor now gives its full power to the car axle, and the stator and its air mechanism will remain at rest as long as the car runs at the speed corresponding to the synchronous speed of the motor.

Speed Variations.—There are usually certain places on any road where high rates of speed can be maintained for short distances, and as these speeds might be higher than the synchronous speed for which the motor was designed they are provided for as follows:

Assuming that the car is running at synchronous speed the controller may be moved to such a position that the valves of stator cylinder S C operate in such a manner as to cause it to act as an engine and revolve stator S in the same direction as rotor R is revolving. This now causes, owing to the constantly electrically maintained relative difference in speed between the stator and the rotor, an increase of speed of the rotor and car axle, due to the motor automatically working as a magnetic clutch, without mechanical contact, and if the resistance of the car or train is less than the capacity of the electric motor the air necessary for revolving the stator can be obtained, hot, from the rotor cylinder R C without drawing from the tanks and a speed above synchronism, indirectly proportioned to the resistance of the train maintained indefinitely. When the resistance of the train is greater than the capacity of the electric motor, speeds above synchronism can be obtained only by supplying rotor cylinder R C with stored air from the tanks, and can only be maintained for short distances, or until the storage capacity of the air reservoirs is exhausted. This condition corresponds to the spurts that can be made by a steam locomotive when working above the steaming capacity of the boiler. The distance from the line O D L to that portion of the line A D S above O D L in Fig. 4 represents, at any given speed, the proportionate amount of energy which must come from the tanks and be supplied through cylinder S C, and the distance from D L to C R represents the total energy given to the car by the combined action of the electric motor and the stator cylinder when operating under these conditions. The energy delivered to the car can be still farther increased by admitting air into rotor cylinder R C and allowing it to work as an engine.

Retardation.—To bring the car or train to rest, instead of applying mechanical brakes to the wheels in the ordinary manner and thereby dissipating the entire stored energy of the car or train in the form of heat, this energy is saved in the form of compressed air, to assist in starting the car or train, by setting the controller in such a position that rotor cylinder R C compresses air and delivers it into the storage tanks. Any desired rate of retardation can be secured by throttling the delivery pipes from rotor cylinder R C, and in practice this pipe is provided with an automatic valve which releases just before the slipping point of the wheels, thus allowing the motorman to brake as rapidly as he desires without liability of flattening the wheels. Supplemental wheel brakes are provided for emergency, but need not often be used, and the ordinary wear and tear on them is saved. When the car is again at rest the cycle of performance as above given is repeated for the next run.

Fig. 8.—Latest Design of Truck with Two Motors.

Reversing.—When it is desired to run the car backward for short distances the electric motor is not disturbed and the power is furnished by the rotor cylinder R C by reversing the action of the valves, but if it is desired to run backward for any great distance the current is thrown off the motor, the stator engine reversed, and the stator brought to speed by the air, when the current is again thrown on to the motor, and the cycle of operation is the same as when running forward.

Figs. 5 and 6 show, mounted upon a truck, two views of the first electro-pneumatic motor constructed, and upon which the first experiments were conducted. The design of the cars constructed for the system is shown clearly in Fig. 2.

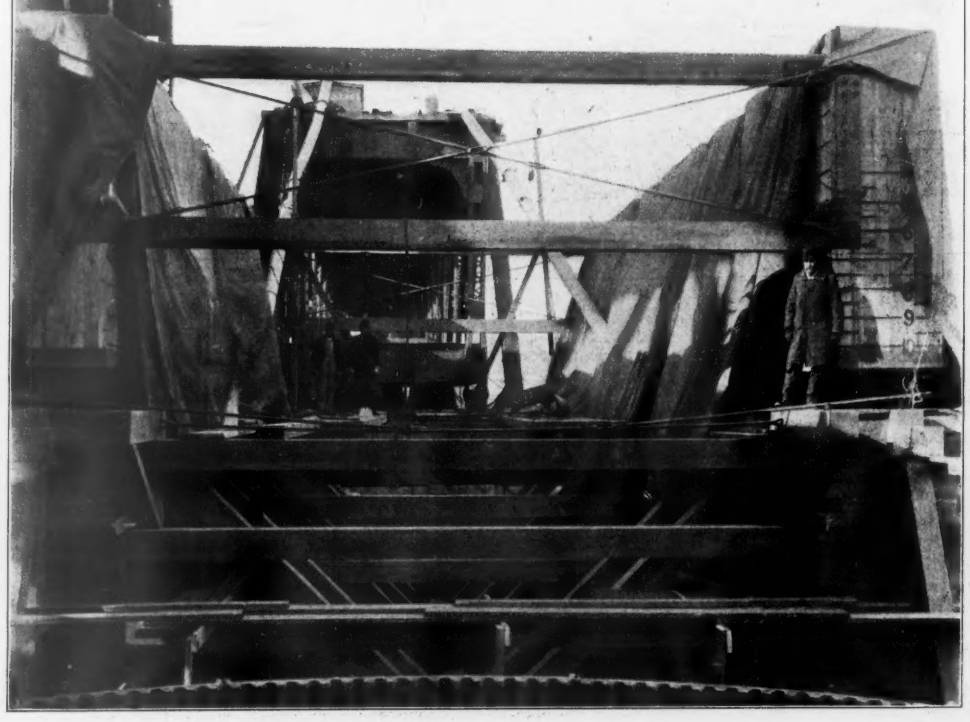
Since the single motor represented in Figs. 5 and 6 was too small in capacity to propel a large car, it was decided to experiment with an improvised locomotive, consisting of the truck and motor shown in Figs. 5 and 6, carrying suitable air tanks and transformers upon a temporary frame structure. This locomotive was the one upon which the trial runs were made and passengers carried on June 15, 1902.

A new electro-pneumatic motor constructed after the preliminary experiments had been made on the first motor was fitted up for experimental purposes in the form of a locomotive as shown in longitudinal and transverse section by Fig. 7, and it was this locomotive that was recently destroyed by fire. In order that the locomotive might operate as an independent air unit upon tracks not equipped with overhead electrical conductor it was provided with a small storage battery and small motor generator for charging the batteries and for operating the headlight. These auxiliaries are not necessary for the successful operation of the system, provided the locomotive can always be supplied with electric current from the working conductor, for then the valves can be made to operate from alternating current and thus eliminate the use of motor-generator and batteries. When, however, it is desired to operate independently of the electric conductor these auxiliaries are necessary, and one set may supply an entire train. It will be seen that the locomotive is also provided with transformers, another auxiliary which is unnecessary in case the motors are designed for the voltage transmitted over the working conductor, but in this case transformers were used because the manufacturer of the motors could not be induced at the time they were purchased to build a high tension motor for railroad work, consequently the parts of a standard motor were utilized, and a pressure of 200 volts adopted for the motors, as this was the most economical voltage that could be used with the particular parts selected. This locomotive was provided with all necessary testing instruments and had been operated in the barns for some time and found to perform all its functions successfully and would have been placed on the road and experiments with it would now be in process had it not been destroyed.

Moving a Drawbridge With Sand Jacks.

The method devised by Lincoln Bush, Chief Engineer of the Delaware, Lackawanna & Western, for lowering bridges into position with sand jacks on floating scows was described briefly in the account of improvements on the Lackawanna printed in the *Railroad Gazette* in November, 1902. On Dec. 20, 1903, a large double deck drawbridge over the Passaic River at Newark, N. J., was moved from its old position to the new location required by the track elevation and changes of line through Newark, and in spite of adverse weather conditions the work was accomplished in the way planned without delays. The accompanying photographs show views of the sand jacks and of the bridge while moving was in progress, although the fact that the latter were taken on a stormy day makes them somewhat flat. We are indebted to the courtesy of Mr. Bush for pictures and information furnished.

In March, 1901, a new draw span was erected at Newark to replace an old bridge not sufficiently strong for the heavy commutation traffic through that city. The new bridge was suitably designed for the elevation work through Newark and Harrison that was to come later. The lower deck of the bridge, previously carrying the main line traffic, is now used for the single track ap-



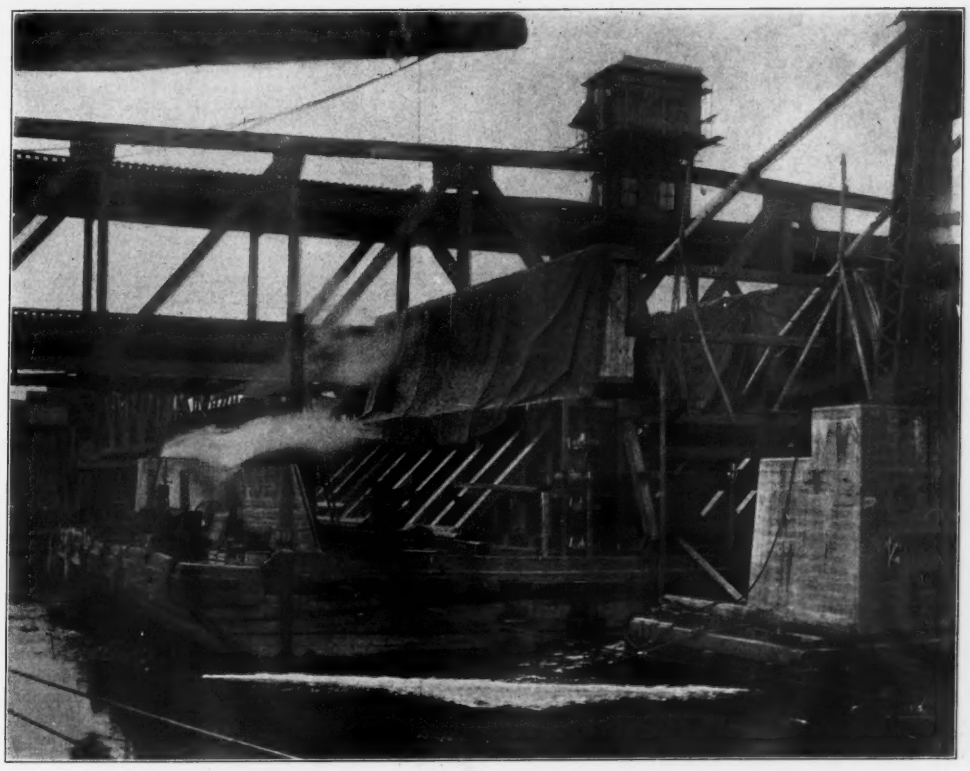
End Elevation of One Pair of Sand Jacks, Showing Method of Bracing.

Bridge in Position at New Location, Ready for Sand to be Drawn from Boxes.

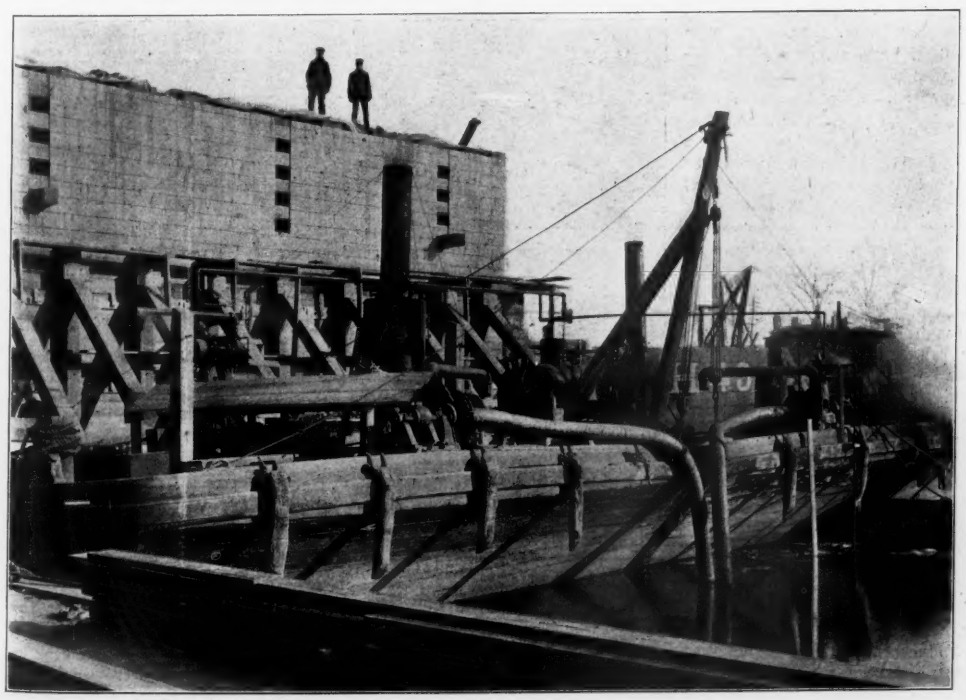
proach to the new freight yard at Broad street, Newark, at the street level, while the upper deck, heretofore unused, is now occupied by the two main tracks. The new grade and location of elevation work were such as to require the bridge to be moved 35 ft. north of and parallel to the old location and placed 10½ ft. below the old elevation.

In most cases where a new bridge is to be floated into the position of an old one or the elevation of a bridge changed, the rise and fall of the tides and the use of ballast water in floats is sufficient for any change in elevation. As the Passaic River bridge had to be lowered over 12 ft., which included the distance the bridge had to be raised to clear old masonry, it was necessary to devise some plan for lowering the structure through this distance in a quick and safe manner. A scheme was proposed in which hydraulic jacks were to be used, the bridge to be floated to its new location and landed on hydraulic jacks resting on new masonry; but there would have been great difficulty in landing the bridge on the jacks on the exact center, for when resting on the jacks the position of bridge cannot be changed. Sand jacks were therefore adopted, as they presented many advantages over hydraulic jacks, including much lower cost.

The chief difficulty to be encountered in an operation of this kind where the bridge is floated in tide water is due to the erratic variations of the heights of tides, and that the tides place a time limit of 12 hours on the various moves to be made. An additional hindrance with the Newark bridge was the constant traffic over it, amounting to 200 trains daily. During a period of several months, daily readings of the tide gage at this point showed that often the high tide had not risen above mean tide or zero, while some high tides were 4 ft. above mean tide. There had been low tides that did not fall below mean tide, but sometimes a low tide would be 3 ft. below mean tide. This indicated that the maximum and minimum variations of tides at this point were 7 and zero ft. respectively, while under normal conditions the average variation between same tides was 5 ft.



Plungers Blocked up to Allow Filling of Sand Boxes from Cars on Elevated Structure.



Side Elevation of Sand Jack Showing Plunger in Position after Sand Box was Filled.

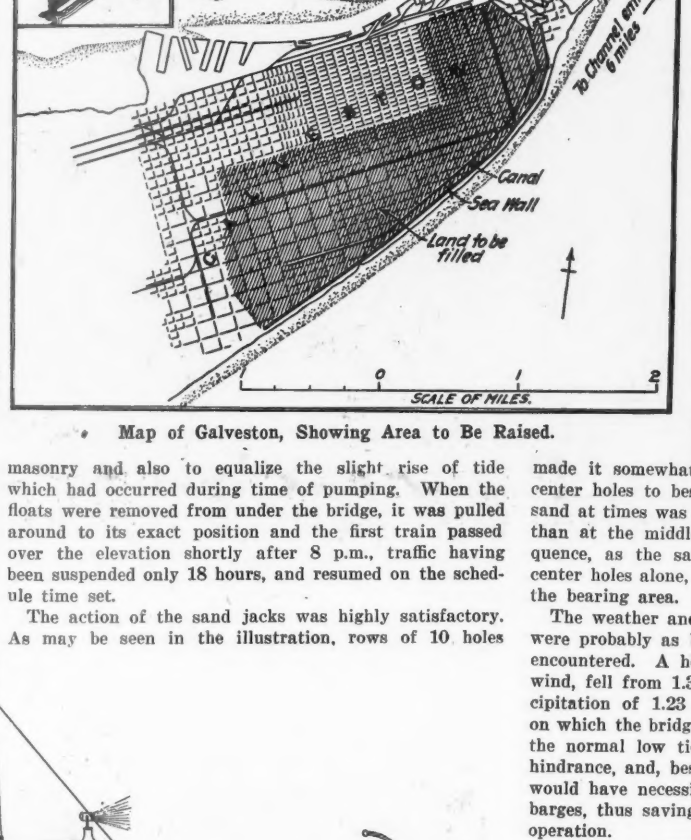
The lowering apparatus consisted of four sand boxes or jacks built on the decks of two floats. There was a pair of jacks on each float and each float consisted of two barges 110 ft. long, 31½ ft. wide and 9½ ft. deep, fastened together with shear blocks so as to act as one float. The jacks consisted of boxes made of 12 x 12 timber, 52 ft. long, 4 ft. wide, and 11½ ft. deep, inside measurement. A heavy timber plunger neatly sheathed fitted inside the box and rested on the perfectly dry sand which filled the box up to within 7 in. of the top. The plunger was of sufficient height to telescope into the box the full depth, when the sand was drawn off through numerous openings, in horizontal rows in the sides and bottom of the box, the number of orifices open being controlled by slides extending one-half the length of the box, operated from the outside ends. Openings in the decks of the barges allowed the released sand to fall to the hold, thus avoiding shoveling. The lower chords of the bridge, which rested almost directly on tops of plungers, were reinforced by diaphragms between flanges, and 12 x 12 timbers were fastened crosswise to under side of chords. These extended more than the full width of bridge and protected the metal work, providing a solid bearing for the bridge on the jacks.

To move the floats up or down stream a system of block rigging was arranged which was operated by two spool engines placed on the up-stream end of the new protection pier just completed. The rigging was such as to allow the floats to be moved in either direction as short a distance as desired. Hand jacks adjusted to the sides of the floats and bearing on sides of the protection pier

made it possible to adjust the floats in any position across the stream. The maximum stroke of plunger of sand jacks was 11 ft., but it was intended to use only 10½ ft. of this stroke. The distance through which the bridge was to be lowered being, as stated, 12 ft., ballast water in the barges and the action of the tide was to be used to make up the remaining distance to land the bridge on new masonry and to sink the floats sufficiently to relieve them of the load of the bridge. For managing the ballast water, one centrifugal pump, capacity 1,600 gallons per minute, was provided for each barge, and there was a complete pumping outfit on pontoons in reserve.

The bridge is 221 ft. long and weighed ready for removal 1,017 tons. The distance between centers of trusses is 29 ft. 3 in., and the distance between decks is 21 ft. 3 in. The lowering apparatus weighed 936 tons, making the total load on decks of barges 1,953 tons. The load carried by each of the four jacks was 254 tons. The sand in each of the boxes offered a bearing surface to plunger of 208 sq. ft., making the pressure on sand in boxes 2,450 lbs. per sq. ft., exclusive of weight of plunger.

On the morning of December 20 the floats were placed in position under ends of bridge at 3.30 o'clock, traffic having been abandoned an hour and a half before. The tide at that time was 1.2 ft. above mean low tide and was receding. Ballast water had been allowed in barges to the depth of 4½ ft. with a freeboard of 2 ft. The four pumps were started and were removing the ballast water at the rate of 1,600 gallons per minute for each pump. After the depth of water had been decreased 25 in. the tops of jacks "snugged" to lower chords of bridge. During this time the tide had reached its lowest point, which was 0.66 ft. above mean low tide at 4.34. The four pumps were now increasing the buoyant power of the floats at the rate of nearly 27 tons a minute. At



Map of Galveston, Showing Area to Be Raised.

Cutter Dredge for Opening the Canal.

7 o'clock the depth of ballast water had been decreased to 2 ft., and the freeboard on barges to 21 in. At this time the floats were carrying the entire weight of the bridge and an hour later, with the assistance of the rising tide, the bridge had been raised 20 in. above its old position. Moving the loaded floats up stream to the new location of bridge occupied about 20 minutes, and at 9.30 the bridge was in position for lowering. High tide occurred at 10.45, and showed a height of 0.43 ft. above mean high tide. The sand was first drawn from one pair of jacks for a depth of 1 ft. Then 2 ft. was drawn from each pair of jacks alternately, the bridge lowering in "see saw" fashion, one end of bridge being 1 ft. higher than the other at the end of a stroke. It was found that when only the rows of holes at bottom of sides and in bottom of boxes were open the plungers settled smoothly and evenly into the boxes. This indicated that the sand in boxes was not arching, so afterward the sand was drawn exclusively from lower holes, excepting for adjustment. It required about five minutes to lower one end of bridge 1 ft., and by 4.30 the structure had been lowered about 10 ft. by means of the jacks. During this time the depth of water in barges had been increased from 2 ft. to 5 ft., and the bridge was now but a few inches above the new masonry. It was necessary in landing the bridge on the pivot pier to have the pivot point at the exact center of the rack and track circle so that the pinions of the turning mechanism would mesh with the rack circle. At the exact center of the rack circle, a metal ring, the shape of an inverted cone was anchored to the top of the pivot pier. The base of the pivot of the bridge is 6 ft. 4 in. in diameter, and its shape is also that of an inverted cone. When the bridge was within a few inches of the masonry these cones engaged each other, bringing the bridge to an exact center when landed in resting position. Low tide occurred at 5 o'clock and had fallen only 3½ ft. below the previous high tide. The height of this tide was 1.15 ft. above the low tide of the morning, and nearly 1.5 ft. above mean low tide. After the landing of the bridge it required one hour of steady pumping to put sufficient water in barges to equalize the load of bridge (1,017 tons), from which the floats had to be relieved by the masonry and also to equalize the slight rise of tide which had occurred during time of pumping. When the floats were removed from under the bridge, it was pulled around to its exact position and the first train passed over the elevation shortly after 8 p.m., traffic having been suspended only 18 hours, and resumed on the schedule time set.

The action of the sand jacks was highly satisfactory. As may be seen in the illustration, rows of 10 holes each run along the top, middle and bottom of the sides, and there are two rows of the same number in the bottom, to draw off the sand, but as the movement of the plunger was even and free from jerks when only the holes in the bottom and in the bottom of sides were open, it was decided to use these holes exclusively, except for adjustment. Experiments on a small scale had been made on sand boxes which showed that the use of sand jacks for lowering bridges would be a safe and feasible method. The experimental boxes were 6 ft. long, 4 ft. wide and 6 ft. high, and two 83 ft. girders, producing a pressure of 2,250 lbs. per sq. ft. on the sand, were used for the load. Holes bored at different angles in sides of boxes showed that the sand would not flow at all through horizontal holes, that through holes at an angle of 30 deg. to the horizontal the sand flowed sufficiently fast to fill one-third of the holes area, and through 45 deg. holes the flowing sand nearly filled the orifices. Through holes in bottom of boxes the sand flowed most freely, but to avoid any possibility of the sand arching in boxes the apparatus for lowering bridge was so designed as to allow of the sand being drawn off at different elevations from sides of boxes until the depth of sand had been decreased one-half. The holes made in the experimental boxes and afterward in apparatus for lowering bridge were 2 in. in diameter on the outside of the box, gaged to 3 in. on the inside. The possibility, previously referred to, that the sand might make trouble by arching, was suggested by the failure of several wheat bins in Minneapolis, Minn., a few years ago, where, after the wheat had been entirely drawn off from the bottom of bins, the remaining wheat formed an arch, thus throwing the entire load above the bottom of bin, on the outer metal shell, and causing it to fail as an overloaded column, rather than by lateral pressure.

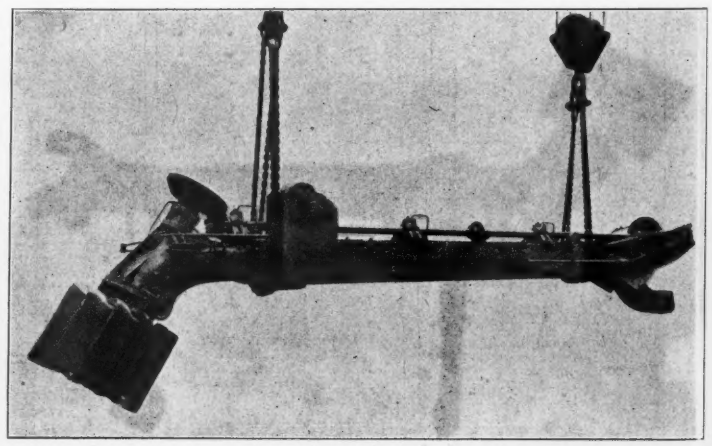
Owing to the driving rain which fell all day the top sand in the boxes became moistened, although the jacks were protected by coverings of heavy canvas. After the plungers had completed about 10 ft. of their 11 ft. stroke, the remaining moist sand refused to flow. This depth of stroke was ample, however, as the extra distance needed was easily gained by sinking the floats with ballast water and by the movement of the receding tides. A slight bulging of about ½ an inch was noticed in the sides of one of the boxes. This was due to the unequal pressure on sand caused by some sand getting wet near middle of box and not flowing as rapidly as at the ends. The swelling of slides provided for the opening and closing of holes, due to the heavy rain, caused a few of them to be abandoned, and men with plugs, previously provided, were stationed at the holes. The heavy canvas covering for protection of the jacks from rain, made it somewhat difficult for the men to operate the center holes to best advantage, and on this account the sand at times was drawn somewhat faster at ends of box than at the middle. But the bulging was of no consequence, as the sand was soon leveled by working the center holes alone, distributing the pressure uniformly on the bearing area.

The weather and tide conditions of the day of moving were probably as bad a combination as could have been encountered. A heavy rain, driven by a high southeast wind, fell from 1.30 a.m. to 5.30 p.m., with a total precipitation of 1.23 in., and the low tide in the evening on which the bridge was lowered was 1.80 ft. higher than the normal low tide. The moisture of the sand was a hindrance, and, besides that difficulty, a normal low tide would have necessitated the use of less ballast water in barges, thus saving considerable time for completing the operation.

Raising the Grade of Galveston.

At the time of the great storm in September, 1900, 40 million dollars worth of property was destroyed at Galveston and 8,000 lives were lost. Galveston is situated on a sandy island and is so low above the water that the abnormally high tide, combined with the waves driven by the hurricane then blowing, entirely flooded the greater portion of the city to a height of 15.7 ft. above mean low water and the residence district was almost entirely wiped out. It was questioned, very seriously, whether it was even worth while rebuilding the city in its present location, so great was the damage done, and there were definite projects for changing the locality of the city entirely. But a deep water harbor, the only one in Texas, had been made at considerable cost, and the railroad terminals which had been established and the values of the land holdings were so great that abandonment of the old location was not considered advisable. It is now familiar history how funds were raised by the issuance of $1,500,000 bonds which were taken by all classes in the city from bankers to clerks.

After the immediate efforts to save property and restore the city to such a condition that business could be carried on, the first step taken to guard against a repetition of the experience in 1900 was to build a sea wall around the southern portion of the city which is exposed to the gulf. A board of engineers consisting of General H. M. Roberts, of the United States Army; Alfred Noble and H. C. Ripley, submitted plans for the wall, which was begun in April, 1902, and is now entirely completed at a cost of $1,000,000. This wall is over three miles long and its top is 3 ft. higher than the high water mark of the 1900 storm. The accompanying photographs, for which we are indebted to the courtesy of the *Review of Reviews*, show three views of the wall, which is 5 ft. wide at the top and 16 ft. wide at the bottom



Suction Pipe and Cutter.

View of Wall from Sea Front Showing Concave Surface at Different Stages of Completion.

and concaved on the southern side, with substantial riprap protection. The riprap consists of large granite blocks and extends seaward for 27 ft. from the base of the wall; its height ranges from 3 to 5 ft. above the surface of the water. The wall itself, which is built of concrete, stands on a foundation of piles driven into the clay beneath.

The sea wall alone was not judged a sufficient measure of protection, for the reason that it would be quite possible, in the event of another hurricane, for water to come around the end of the wall and do much damage in the low land behind it, where they would be confined. Hence it was decided to raise the grade of that portion of the city which was flooded, to a height of 17 ft. above mean high water, or level with the top of the wall. The average filling is to a depth of 7 to 8 ft., but in some places from 17 to 20 ft. of earth must be filled in and the total work involves 11,000,000 cu. yds. of filling, at an estimated cost of $2,100,000 in addition to the cost of the wall.

The accompanying map, traced from the government pilot chart, shows the location of the city on the island, and the sea wall is indicated by the outer of the two lines drawn inside the city limits. The shaded portion of the city represents the part on which the grade is to be raised. The character of the surface soil is like that of any other sand bar in the ocean, and the storm washed a large amount of sand from the gulf front of the city out towards the west jetty, creating flats at the eastern end of the city. The approach for vessels is on this side, as the exposed shore facing the Gulf of Mexico offers no protection for vessels.

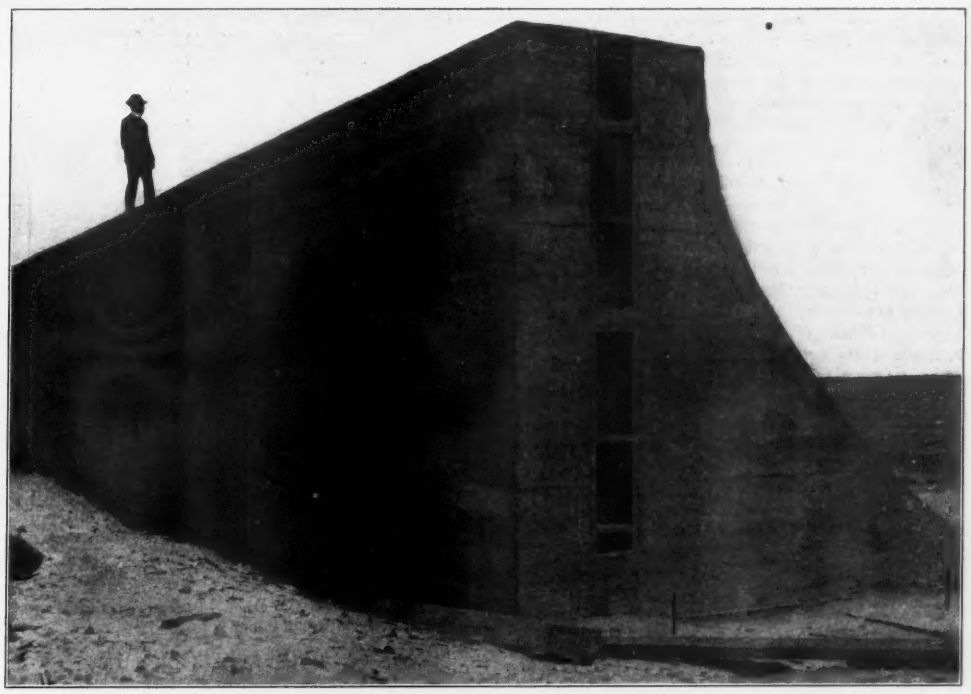
The means of accomplishing this filling in of the city behind the wall without encountering prohibitive difficulties occasioned much discussion and several plans were suggested. It was necessary, first of all, to get the material for filling at a short enough carry to be economically feasible. There was plenty of sand on the shoals directly east and southeast of the sea wall; but this sand, which is covered with water at a low tide depth of from 1 to 12 ft., served as a protecting beach of considerable value and it was considered inadvisable to strip it away. Moreover, the wave motion on the sea front and the danger of storms would have seriously interfered with the work of self-loading hopper dredges, which it was for a time proposed to employ, with the idea that they could go under their own steam to distributing stations on the sea front or on the bay front, while, if the filling material were distributed from the bay or channel front (shown on the map to the northward of the city) the long pipes through which the sand and water would have to be discharged would be seriously in the way of traffic, somewhat like fixed bridges over a crowded stream, while there would be no easy outlet for the surplus water after the spoil had been deposited in the required locality. The objections due to the waste water and to stripping the protecting beach also applied to the plan of using ordinary pumping dredges which should discharge over the sea wall, and of running long suction pipes seaward from shore stations, discharging over the sea wall.

It was proposed also to establish a borrow pit south of the city on Galveston Island (not shown on the accompanying map). This plan would have been feasible enough except for the cost of relay stations and the fact that the great borrow pits would limit the city's growth in a direction to which it is naturally tending. The prohibitive cost also prevented the establishment of a similar borrow pit operated by dredge, grab, or steam shovel, from which the sand would be hauled to the city on a temporary railroad.

Hydraulic dredging along the wharf front on the north of the city was good in that it would deepen the channel and dispose of some of the sand put there by the flood; but it would have occasioned a tremendous impediment to business, with the necessary piping through the principal streets and back flow of waste water.

The plan finally adopted for filling the low portion of the city was devised by Lindon W. Bates, who is engineer of the work in progress. In addition to a large number of dredging operations abroad, it will be recollected that Mr. Bates dredged a section of the Chicago drainage canal. The basis of Mr. Bates's plan is to dredge a canal, which will be 100 ft. wide on the bottom and 20 ft. deep, parallel to and just inside of the sea wall, as shown by the inner line in the accompanying map. The canal will not only afford a convenient inlet into the heart of the portion to be filled without involving piping through the city streets, but will also serve to carry off waste water.

Two types of dredges are to be used. The canal will be dug from the north, or channel side, of the city by means of a cutter dredge, a plan of which is shown in the accompanying drawings, with a photographic reproduction of the cutter at the end of the suction pipe. The dredging mechanism consists of a centrifugal pump, fed from a single suction ladder which carries a built up cutter. The latter is cylindrical, with straight blade milling cutters mounted around and concentrically with the end of the suction pipe. In this type the whole cutter may be secured to the end of the suction pipe and rotary motion imparted to both together; or the cutter shaft may be journaled, by a suitable bearing provided in the end of the suction pipe, which is then made stationary. The material severed by the cutter is drawn through the spaces between the knives and openings are also provided in the conical disk at the end of the cutter fitted with detachable knives, an arrangement which has been found advantageous in clayey soils. Power is transmitted to the cutter by means of a shaft on the top of a ladder which drives the cutter by means of spur gearing where the axes are parallel, or beveled gearing when the bend is employed. A thrust block on the bend casting contains the upper end of the cutter spindle, and this thrust block, in common with all bearings under water, is lubricated with water under pressure, so as to exclude sand or grit. The gears are en-



Side View Showing Contour of Completed Wall.

Section of Completed Wall and Riprap Facing.

cased in sand tight hoods, with the same object. The pump discharge is taken through the stern of the vessel, and flexible connection is made with a line of pipe pontoons.

After the canal is completed by cutter dredges, sand will be dredged from the flats on the north side of the channel by means of dredges of a different type. These other dredges will be vessels of about 1,000 tons, carrying approximately 1,365 yards of filling material, which will be drawn into hoppers in the hold by means of a suction pipe. The dredge will then proceed up the canal to the discharge station, where connection will be made to a discharge pipe on the bank. The sand in the hold is mixed with water in the hoppers and discharged by means of a centrifugal pump. At the completion of the work the canal will be filled from the inner end, while the dredges gradually retire from it.

In addition to the grade change in the city, the navigable waters and channels of the bay close to the city will be deepened considerably by the method of dredging, and it is estimated that this improvement will be worth 1½ millions to the city. Owing to the canal, the business center of the city will not be encumbered by pipes or its streets injured by waste water, and there will be no danger from storms, as the dredges will always work under shelter.

The top of the sea wall will be used as a walk, and immediately back of it, on the made land, there will be a driveway 30 ft. wide, paved with stone and concrete. There will be another walk on the inner side of the driveway and the remaining space will be sodded and planted with trees and shrubs, which will serve the double purpose of tying down the soil and of making an esplanade and continuous park along the sea front of the city.

The project for thus redeeming the city from what amounted to almost total destruction and making it apparently secure for all time, is doubly interesting when it is realized that the population of Galveston is only about 40,000, and that the energy and initiation for the work, as well as the financial means, came almost entirely from the city itself.

Railroad Built in 1903.

Official returns from the majority of the railroad companies in the country supplemented by our own records and figures furnished by the State Railroad Commissioners, show that approximately 5,652 miles of new main track have been built in the United States during the calendar year 1903. These figures do not include second track, sidings, or electric lines. Although the total for the year shows a falling off from our figures for 1902, the decrease is no doubt due to temporary suspensions in construction work by some of the larger railroad companies at various times during the year.

Railroad building is reported in 43 States and territories, including Alaska, where 10 miles of new track were built during the past year. Oklahoma leads the list with track laid on 661 miles, an increase of 100 miles over 1902. Louisiana is second with 390 miles, Indian Territory third with 387 miles, and Texas is fourth with 351 miles. The large decrease in new mileage built in Texas may partly be accounted for by the fact that the Texas Railroad Commission by a strict and literal interpretation of the law, has put a decided check on railroad building in that State. In addition to the above, Pennsylvania, Minnesota, Missouri, Arkansas and Iowa show returns of over 200 miles built; and Alabama, Arizona, California, Georgia, Illinois, Michigan, Mississippi, New Mexico, North Dakota, Ohio, Tennessee, Utah, Washington, West Virginia and Wisconsin built over 100 miles of main track. No new mileage was reported from Connecticut, Delaware, Idaho, Kansas, New Hampshire, Nebraska, or Wyoming. The following table shows our figures for the past decade.

Mileage Built in United States.

1893	3,024	1899	4,569
1894	1,760	1900	4,894
1895	1,428	1901	5,368
1896	1,692	1902	6,026
1897	2,109	1093	5,652
1898	3,265		

Table Showing Mileage Built During 1903, Classified by States.

	No. of Cos. building.	1903.	No. of Cos. building.	1902.
Alabama	4	129.39	11	101.78
Alaska	1	10	..	....
Arizona	3	107.07	4	84.46
Arkansas	14	230.77	15	371
California	8	169.55	11	136.5
Colorado	6	89.07	3	55.36
Connecticut	..	....	1	4
Florida	5	53.05	7	144
Georgia	11	133	15	336.37
Illinois	6	114.3	9	231.9
Indiana	4	43.32	3	79.85
Indian Territory	6	386.8	7	362.95
Iowa	5	229.2	7	209.74
Kansas	..	....	3	58.52
Kentucky	5	69.45	2	34
Louisiana	11	389.63	11	146.35
Maine	1	6.5	6	85.84
Maryland	2	12.82	..	....
Massachusetts	1	2.37	1	4
Michigan	13	158.68	19	144.23
Minnesota	6	262.1	8	167.32
Mississippi	6	116.4	4	131
Missouri	7	236.2	7	231.27
Montana	2	70.5	3	59
Nebraska	..	....	2	73.5
Nevada	1	20	1	95
New Jersey	1	4.84	..	....
New Mexico	2	158	4	279.6
New York	3	33.83	8	63.18
North Carolina	7	94.5	8	76.8
North Dakota	4	130.57	5	98.12
Ohio	9	134.19	9	132.1
Oklahoma	8	660.6	6	570
Oregon	3	21.75	2	21
Pennsylvania	16	286.37	24	199.84
Rhode Island	1	3.4	..	....
South Carolina	4	34	1	6
South Dakota	1	15.56	3	57.56
Tennessee	3	114.9	6	50.31
Texas	15	361.26	18	495.67
Utah	4	186.16	3	81
Vermont	1	5.25	1	2
Virginia	3	27.42	7	54.14
Washington	7	111.22	6	139.17
West Virginia	9	103	13	140.48
Wisconsin	6	125.48	9	146.5
Total, United States	235	5,652	293	6,026
Canada	11	687	13	341
Mexico	5	299	11	292

United States.

ALABAMA.

Carrollton Short Line—Aliceville to Carrollton	10.00
Central of Georgia—Sellersville to Florala	24.00
Eastern of Alabama (L. & N.)	19.80
Louisville & Nashville—Florala to Opp, 23.48 miles; Cain Creek branch, 11 miles; North Alabama R. R. spur, 14 miles; total	48.48
Southern—Spurs to mines, 13.51 miles; Warrior Southern branch, Tidewater mines to Central City, 13.60 miles; total	27.11
	129.39

ALASKA.

Council City & Solomon River—Out of Solomon	10.00

ARIZONA.

Arizona & Colorado—Cochise to Pearce	17.00
El Paso & Southwestern—Fairbank to Tombstone, 9.30 miles; French to French Springs, 29.27 miles; total	38.57
Santa Fe, Prescott & Phoenix—Bradshaw Mt. branch, Turkey Creek to Saddle, 9.70 miles; 2½ miles west of Tempe to four miles west of Florence, 41.60 miles; total	51.30
	106.87

ARKANSAS.

Arkansas Southwestern—From end of line	10.00
Cache Valley—Newport northeast	5.00
Choctaw, Oklahoma & Gulf—White & Black River Valley extension, Newport to Jacksonport	4.40
De Queen & Eastern—From end of track east	10.00
El Dorado & Bastrop (St. L., I. M. & S.)—Eldorado east 20.4 miles; La. and Ark. State line west, 7.30 miles; total	27.70
England & Clear Lake—England to Lockville	5.00
Jonesboro, Lake City & Eastern—Blytheville to Barfield Point	10.00
Midland Valley—Hartford to Greenwood	20.00
Mississippi, Arkansas & Western—East from Martin's	4.00
Paragould & Memphis—Manilla northwest to Missouri State line	14.00
Paragould Southeastern (St. L. S. W.)—Missouri State line to Blytheville	12.79
St. Louis & North Arkansas—Gilbert to Leslie	19.63
St. Louis & San Francisco—Hope to Ashdown, 35 miles; Evadale towards Big Creek, 4 miles; total	39.00
White River (Missouri Pacific)—Mt. Olive to Cotter	49.25
	230.77

CALIFORNIA.

Butte County—Chico to Coutolene	23.00
California Northwestern—Willits towards Christine, 10 miles; Guerneville to Camp Vacation, 4 miles; total	14.00
Eureka & Klamath River—Campa to Luffenholz	3.00
Imperial & Gulf (Southern Pacific)—Old Beach to Imperial	28.00
McCloud River—From end of track east	14.00
Oakland & East Side (Atch. Coast Lines)—Oakland to Richmond	11.50
Port Angeles Pacific—Port Angeles to Dry Creek	6.00
San Francisco & Northwestern (Atch. Coast Lines)—Burnells to Carlotta	3.50
San Pedro, Los Angeles & Salt Lake—Daggett east, 40 miles; Pedley to Riverside, 7 miles; total	47.00
Sunset R. R. (Atch. Coast Lines)—Sunset to Maricopa	2.60
Southern Pacific—Montalvo branch, Chatsworth Park to Burbank	16.95
	169.55

COLORADO.

Colorado & Southern—Fort Collins to Wellington	11.50
Colorado Springs & Cripple Creek District	59.24
Denver & Rio Grande—Howards to Howards Quarry	5.83
Denver, Northwestern & Pacific—Arvada towards Leyden	4.50
Rio Grande & Pagosa Springs—Blanco to Chambers	4.00
Silverton Northern—Eureka to Ammas Forks	4.00
	89.07

FLORIDA.

Atlantic Coast Line—Punta Gorda to Fort Myers	28.00
Brooksville & Hudson—Line completed to Hudson	4.00
Florida East Coast—Miami South	10.00
Florida West Shore (Seaboard Air Line)—Oneco to Sarasota	9.05
Suwanee & San Pedro—Mayo to Alto	2.00
	53.05

GEORGIA.

Atlantic Coast Line—Otisca to Amsterdam	10.30
Brunswick & Birmingham—Bushnell to Irwinville	24.00
Central of Georgia—Cremo to Cloud Springs	2.50
Flint River & Gulf—Ashburn towards Sylvester	2.00
Flint River & Northeastern—Pelham to Doe Run	26.00
Millen & Southwestern—Stillmore to Vidalia	21.00
Ocilla, Pinebloom & Valdosta—Garretts to Nashville	6.00
Southern—Roswell branch, spur to Morgan's Falls	2.60
South Georgia & West Coast—Adel to present line	4.60
Tallulah Falls—Tallulah to Tiger Creek, 8 miles; Tiger Creek to North Carolina State line, 15 miles; total	23.00
Wadley & Mt. Vernon—Broxton to Barrows Bluff	11.00
	133.00

ILLINOIS.

Chicago & Eastern Illinois—Findlay to Pana, 20 miles; Woodland toward Villagrove, 12 miles; total	32.00
Chicago, Milwaukee & St. Paul—Ashdale to Elner	15.00
Illinois Central—Mounds to Olive branch, 7.3 miles; Gale to Thebes, 1 mile; total	8.30
Illinois Valley Belt—Peoria to Pekin	11.00
Marquette, Spring Valley & Northwestern—Spring Valley to Marquette	5.00
Rochelle & Southern (C., M. & St. P.)—Steward to Ladd	37.00
Toluca, Marquette & Northern—Henry Jct. to Broaddus, 5 miles; McNabb to Ind. Ill. & Ia. crossing, 1 mile; total	6.00
	114.30

INDIANA.

Chicago & Eastern Illinois—Pence to Judyville	7.00
Chicago Terminal Transfer—Clarke Jct. to Pine	.70
Cincinnati, Bluffton & Chicago—Bluffton to Pennville	17.00
Pere Marquette—State line to Porter	18.62
	43.32

INDIAN TERRITORY.

Ark. Valley & West. (St. L. & S. F.)—Red Fork to Okla. Ter. line	10.00
Chicago, Rock Island & Pacific—Chickasha southeast to 6 miles beyond Lindsay	32.00
Choctaw, Oklahoma & Gulf (C., R. I. & P.)—Halleyville towards Wilburton	7.70
Fort Smith & Western—Garner to Okla. Ter. line	64.00
Missouri, Kansas & Texas—Coalgate to Ada, 35.4 miles; Coweta northwest to State line, 37 miles; Gaines' Creek to M., K. & T. mines, 13 miles; Bartlesville to State line, 2 miles; total	87.40
Muskogee Southern—Muskogee to Russell	22.00
Ozark & Cherokee Central—Tahlequah to Okmulgee	75.00
St. Louis & San Francisco (St. L., S. F. & N. O.)—Bennington to Ardmore, 71 miles; Scullin to Sulphur Springs, 8.7 miles; Platter cut-off, 9 miles; total	88.70
	386.80

IOWA.

Chicago, Burlington & Quincy—Oskaloosa to Tracey	13.08
Chicago Great Western—Oelwein to Waverly	28.12
Chicago, Milwaukee & St. Paul—From a point 20 miles east of Muscatine to Rutledge	56.00
Iowa & St. Louis—From a point near Centerville to Clarkdale	8.00
Mason City & Fort Dodge (C. G. W.)—Manning to Council Bluffs	65.00
Newton & Northwestern—Fraser to Newton	59.00
	229.20

KENTUCKY.

Chesapeake & Ohio—White House to Elkhorn City	6.40
Illinois Central—East Cairo to Paducah	23.90
Kentucky & Tennessee—Stearns to Barthell	3.60
Louisville & Nashville—Middlesboro extension, 9 miles; Brush Creek branch, 4.85 miles; Saxton to Tenn. State line, 5 miles; total	18.85
Tennessee Central—State line to Hopkinsville, 8 miles; Cranford to Wilder, 6.7 miles; South Harriman to Harriman, 2 miles; total	16.70
	69.45

LOUISIANA.

Arkansas Southeastern—Cherry Ridge to Tugwell City	12.00
East Louisiana—Covington to Blair	3.83
Louisiana & Arkansas—Winnfield to Jena	39.00
Louisiana & Northwest—Lucky to Natchitoches	36.50
Louisiana Railway & Navigation—Colfax to Winnfield, 34 miles; Mansura to Water Valley, 20 miles; Baton Rouge to Irene, 12 miles; total	66.00
Louisiana Western—End of Track to Hayes	12.00
Rochelle & Western—Not specified	5.00
St. Louis, Iron Mountain & Southern (Memphis, Helena & Louisiana)—Ark.-La. State line to Clayton	102.50
Texas & Pacific—Howard to Shreveport, 26.5 miles; Rougere to Concordia, 26.3 miles; Donaldsonville to Napoleonville, 16 miles; total	68.80
Tremont & Gulf—Lindsay Jct. to Eros	7.00
Victoria, Fisher & Western—Victoria to Leach	37.00
	389.63

MAINE.

Madrid (Phillips & Rangeley)—Madrid Jct. to township 6	6.50

MARYLAND.

Philadelphia, Baltimore & Washington—High St., Chestertown to Chester River	.82
Washington, Potomac & Chesapeake—Washington toward Brandywine	12.00
	12.82

MASSACHUSETTS.

Boston Elevated—West End street extension	2.37

MICHIGAN.

Detroit & Mackinac—Waverly to Cheboygan, 17.85 miles; Onaway to Black Lake, 5.17 miles; Omer to Au Gres, 7.96 miles; total	30.98
Detroit & Toledo Shore Line—Monroe to Trenton	30.00
Escanaba & Lake Superior—Branches	12.00
Grand Trunk Western—Battle Creek to Renton	6.58
Harbor Springs—Carys to Indian Garden, 1 mile; Carys to Chrystal Springs, 1 mile; total	2.00
Lake Shore & Michigan Southern—Not specified	5.42
Lake Superior & Ishpeming—Eagle Mills to Maas mine	4.00
Manistee & Northeastern—River branch to Sherman	12.50
Mason & Oceana—Walkerville to Maple Range	11.00
Mineral Range—Riddle Jct. to Michigan	3.40
Pere Marquette—Harbor Beach to Port Hope, 7.8 miles; New Buffalo to Ind. State line, 2 miles; total	9.80
Port Huron & Southern—Not specified	1.00
Traverse City, Lebanon & Manistique (G. R. & Ind.)—Traverse City to Northport	30.00
	158.68

MINNESOTA.

Chicago, Milwaukee & St. Paul—Zumbrota towards Faribault, 28 miles; Le Sueur Center to Mankato, 20 miles; Preston to Isinours, 4.46 miles; total	52.46
Duluth, Missabe & Northern—Mitchell & Buffalo Mine, 0.5 mile; Mitchell to Morris, 1.27 miles; Oliver to Chisholm, 2.65 miles; total	4.42
Duluth, Virginia & Rainy Lake—End of main track to Ashawa, 10.1 miles; logging branch, 10.2 miles; total	20.30
Great Northern—Kelley Lake to Exnose, 9.69 miles; Crosby mine spur, 1.56 miles; total	11.25
Minnesota & International—Dexter to Northome	7.00
Minnesota & North Wisconsin—Nickerson to Nemadji River, 15 miles; Scanlon to Adolph, 50.2 miles; Carolan south, 5.2 miles; spur, 1.27 miles; total	71.67
Minneapolis, St. Paul & Sault Ste. Marie—Glenwood to Detroit	95.00
	262.1

MISSISSIPPI.

Gulf & Ship Island—From Mendenhall south	13.00
Mobile, Jackson & Kansas City—Beaumont to Laurel, 41.6 miles; Laurel west, 18.4 miles; total	60.00
Nashville & Mississippi Delta—Okolona to Houston	20.00
Natchez, Columbia & Mobile—Topeka to point four miles northeast	4.00
Pearl & Leaf River—Prentiss to Silver Creek	9.40
Yazoo & Mississippi Valley—Yazoo City extension	10.00
	116.40

MISSOURI.

Campbell & St. Francis Valley—Campbell to Buckhorn	20.00
Chicago, Rock Island & Pacific—Kansas City toward St. Louis	50.00
Missouri Pacific—Carthage & Western branch, Carthage to Asbury	18.20
Paragould & Memphis—Cardwell south to Ark. State line	6.00
Paragould Southeastern—Hornersville to State line	2.00
St. Louis & Gulf—Not specified	25.00
St. Louis, Memphis & Southeastern—Paw Paw to Cape Girardeau	53.00
St. Louis, Kansas City & Colorado—Gasconade River to Versailles	62.00
	236.20

MONTANA.

Montana & Great Northern—Columbia Falls to Whitefish	8.00
Montana R. R—Harlowton to Lewiston	62.50
	70.50

NEVADA.

San Pedro, Los Angeles & Salt Lake—Calientes south	20.00

NEW MEXICO.

Rio Grande & Southwestern—Lumberton towards Galina	33.00
Santa Fe Central—Torrance to Santa Fe	125.00
	158.00

NEW JERSEY.

New Jersey Terminal—Junction to Carteret	4.34

NEW YORK.

Battenkill—Schuylerville to Greenwich	7.25
Brooklyn Heights—Gravesend Ave. to 59th St., 1.03 miles; Church Ave. to L. I. R. R., 0.48 mile; total	1.51
Pittsburg, Shawmut & Northern—Olean Jct. to State line Jct., 2.2 miles; Angelica to Bolivar, 22.87 miles; total	25.07
	33.83

NORTH CAROLINA.

Caney River—Not specified	15.00
Cape Fear & Northern—Angier to Dunn	20.00
Durham & Charlotte—Star to Little River	3.50
Northampton & Hertford—Gumberry to Jackson	9.00
Raleigh & Cape Fear—Fuguay Springs to Lillington	14.00
Suffolk & Carolina—Beckford to Elizabeth City	23.00
Transylvania—Toxaway to Lake Toxaway	10.00
	94.50

NORTH DAKOTA.

Bismarck, Washburn & Great Falls—Washburn to Underwood, 13 miles; Chapin to mine No. 2, 2 miles; total	15.00
Chicago, Milwaukee & St. Paul—Strasburg to Linton	8.87
Great Northern—Granville to Mohall, 46.4 miles; Souris to Westhope, 16 miles; total	62.40
Northern Pacific—McKenzie to Linton	44.30
	130.57

OHIO.

Adena (W. & L. E.)—Maynard extension	6.00
Chicago, Cincinnati & Louisville—State line near Peoria, Ind., to Cincinnati	32.94
Detroit Southern—Centre to Bloom	15.15
Lake Shore & Michigan Southern—Plymouth to Dorset, 10.2 miles; Latimer to Doughton, 6.9 miles; total	17.10
Ohio River & Columbus—Ripley to Georgetown	14.00
Pittsburg, Carnegie & Western—Jewett to Ohio River	20.00
Toledo & Western—Fayette to Pioneer	13.00
Toledo Ry. & Terminal—Not specified	6.00
Zanesville, Marietta & Parkersburg	10.00
	134.19

OKLAHOMA.

Arkansas Valley & Western (St. L. & S. F.)—Keystone toward Avard	145.00
Atchison, Topeka & Santa Fe—Eastern Oklahoma extension	100.00
Blackwell, Enid & Southwestern (St. L. & S. F.)—Snyder to Tex. State line	33.00
Chicago, Rock Island & Pacific—Faxon to Chattanooga	6.00
Choctaw, Oklahoma & Gulf—Chandler to a point 10 miles from Guthrie	28.00
Fort Smith & Western—Prague to Guthrie	56.00
Kansas City, Mexico & Orient—Okla. Ter. line to Fairview	56.00
Missouri, Kansas & Texas—Fallis to Guthrie, 23.2 miles; Osage Jct. southeast, 20.9 miles; two miles west of Bartlesville to Oklahoma City, 144.5 miles; total	188.60
St. Louis & San Francisco—Leger to Tex. State line	18.00
St. Louis, El Reno & Western—Guthrie to Lockridge, 20 miles; Guthrie towards El Reno, 10 miles; total	30.00
	660.60

OREGON.

Klamath Lake—State line to Pokegama	8.00
Oregon & Southeastern—mile post 13 to mile post 17	4.00
Salem, Falls City & Western—Dallas to Falls City	9.75
	21.75

PENNSYLVANIA.

Buffalo & Susquehanna—Sinnemahoning to Driftwood	6.00
Buffalo, Rochester & Pittsburg—Elders Ridge Jct. to Parkwood, 9 miles; Indiana Jct. to point south of Ernest, 31 miles; total	40.00
Clearfield Southern (N. Y. C. & H. R.)—Potts Run Jct. to Irvona	4.00
Hickory Valley—Extension of Queen division	1.00
Leetonia—Four Mile Run to Bear Run	4.50
Lines West—C. & P. R. R. station at Rush Run to coal mines, 6.84 miles; mine No. 1 to mine No. 5 on W. N. Y. & P., 2.6 miles; meadow lands on Chartiers Ry. toward Zedicker, 1.72 miles; Burgettstown south to coal fields, 0.58 miles; total	11.74
New York Central & Hudson River—Burnside to Cherry Run	9.05
Northampton & Bath—Northampton to Bath	6.00
Pennsylvania—Bedford to Imler, 9 miles; Vintondale to Wehrum, 2.6 miles; Ellsworth to shaft No. 4, 2.9 miles; total	14.50
Pittsburg, Carnegie & Western—Ohio River to Pittsburg	36.50
Spring Creek	7.00
Susquehanna & New York—Laquin to Ralston, 26 miles; Ralston to Grays Run Jct., 8 miles; total	34.00
Susquehanna, Bloomsburg & Berwick—Eyersgrove to Berwick	20.00
Western Allegheny—Queen Jct. to Kaylor, 18.38 miles; Blackburn to Snow Hill, 3.2 miles; total	21.58
West Side Belt—Bruce to Clairton	8.00
Wilkesbarre & Hazleton—Penobscot Tunnel to Ashley	5.00
Winifrede—Winifrede Jct. to Brookville	3.50
	286.37

RHODE ISLAND.

Newport & Wickford—Wickford Jct. to Wickford Landing	3.4

SOUTH CAROLINA.

Bennettsville & Cheraw—Bennettsville to Cheraw	14.00
Carolina & Western—Out of Fechtig	6.00
Charlotte, Monroe & Columbia—Mcbee to Hamburg	11.00
Edgmoor & Manetta—Lando to Edgmoor	3.00
	34.00

SOUTH DAKOTA.

Chicago, Milwaukee & St. Paul—Woonsocket to Wessington Springs	15.56

TENNESSEE.

Knoxville, La Follette & Jellico (L. & N.)—Ky. State line towards La Follette, 5 miles; Beaver Ridge to Knoxville, 14.7 miles; total	19.70
Louisville & Nashville—Stony Fork Jct. to Logmont	6.00
Nashville, Chattanooga & St. Louis—Bon Air to Ravenscroft, 7 miles; De Rosette towards Eastland, 2.5 miles; Tracy City towards Coalment, 4 miles; total	13.50
Tennessee Central—Nashville to Ky. State line	75.70
	114.90

TEXAS.

Atchison, Topeka & Santa Fe (Gulf, Beaumont & Kansas City line)—San Augustine to Center	20.00
Blackwell, Enid & Southwestern (St. L. & S. F.)—From Tex. State line to Vernon	5.00
Cane Belt—Bonus to Garwood	10.00
Chicago, Rock Island & Gulf—Fort Worth to Dallas	32.00
Fort Worth & Rio Grande (St. L. & S. F.)—Colorado River to Brady	28.20
Granger, Georgetown, Austin & San Antonio (M., K. & T.)—Granger to Georgetown	14.90
Gulf & Interstate—High Island to Port Bolivar (reconstructed)	28.00
Gulf, Colorado & Santa Fe—Bragg to Saratoga	10.00
International & Great Northern—Madisonville branch, Madisonville to Navasota	44.70
New York, Texas & Mexican—Bay City to Tres Palacios, 32.08 miles; Van Vleck to Hawkinsville, 17.05 miles; total	49.13
Northeast Texas—Not specified	14.00
Oklahoma City & Texas (St. L. & S. F.)—Red River to Quannah	8.70
St. Louis, Brownsville & Mexico—From Sinton south	25.00
St. Louis Southwestern—Dallas branch, 0.7 mile; extension beyond Monterey, 4.5 miles; total	5.20
Texas & New Orleans—Sour Lake branch	7.18
Trinity & Brazos Valley—Mexia toward Cleburne	58.00
Wichita Valley—Not specified	1.25
	361.26

UTAH.

Malad Valley (Oregon Short Line)—Corinne to Garland	14.78
Oregon Short Line—Terminus to Twin Cuts	63.00
Rio Grande Western—Dalton to Lark, 3.88 miles; Salina to Nioche, 20 miles; total	23.88
Southern Pacific—East shore of Great Salt Lake to Ogden	82.50
Union Pacific—Cut-off near Hampton siding	2.00
	186.16

VERMONT.

Manchester, Dorset & Granville	5.25

VIRGINIA.

Marion & Rye Valley—Currin to Sugar Grove	13.50
Norfolk & Southern—Kempsville Jct. to Providence Jct.	7.30
Norfolk & Western—4.5 miles west of Ivanhoe to Cripple Creek	6.62
	27.42

WASHINGTON.

Bellingham Bay & British Columbia—Maple Falls to Columbia, 7.32 miles; Hampton to Lynden, 5.26 miles; total	12.58
Columbia River & Northern—Lyle to Goldendale	46.00
Great Northern—Fairhaven to Belleville	9.84
Northern Pacific—Coulee Jct. to Adrian, 21 miles; Humptulips northwest, 7.8 miles; total	28.80
Oregon Railroad & Navigation—Seltice to Tekoa	6.00
Portland, Vancouver & Yakima—Branch line east of Vancouver	4.00
Tacoma Eastern—Ohop to Eatonville	4.00
	111.22

WEST VIRGINIA.

Big Sandy, East Lynne & Guyan—Wayne to East Lynne coal fields	8.00
Buckhannon & Northern—New Brownsville toward Bellington	30.00
Chesapeake & Ohio—Midkiff to Logan, 23.3 miles; Imperial Jct. to Mahan, 2.5 miles; total	25.80
Clover Run—Parsons to Walther	7.00
Coal & Coke—Leiter to Kingsville	7.00
Deepwater—Deepwater to Robson	5.00
Kellys Creek & Northwestern—Cedar Grove to Ward	4.00
Morgantown & Kingwood—Masontown to Bretz	1.70
Norfolk & Western—Welch up Tug River, 12.5 miles; Cephas down Bluestone River, 2 miles; total	14.50
	103.00

WISCONSIN.

Chicago & North Western—Ingersoll branch, Eland Jct. to Rosholt	20.08
Dunbar & Wausaukee—Not specified	5.00
Eau Claire, Chippewa Falls & Northeastern (C. & N. W.)—Sillhawn to Yellow River	14.80
Hawthorne, Nebagamon & Superior—Nebagamon to Poplar, 4 miles; Winne Boujoun to log camps, 8 miles; total	12.00
Stanley, Merrill & Philips—Stanley to Hannibal, 24 miles; Bellington to Diamond Lake, 7 miles; total	31.00
Tony & Northeastern—From Tony northeast	18.00
Wisconsin & Michigan—Noquebay Jct. to Lake Noquebay, 8 miles; Falthorn Jct. to Quinnesec, 16.6 miles; total	24.60
	125.48

Canada.

Beersville—Beersville, N. B., to connection with Intercolonial	7.00
Canadian Northern—Greenway to Wakopa, 40 miles; Portage La Prairie to Arizona, 35 miles; Humerston to Carberry, 18 miles; Winnipeg to Oak Point, 53 miles; Grandview to end of steel, 93 miles; Erwood to Melfort, 106 miles; total	345.00
Canadian Pacific—40 miles northwest of Kirkella, Man., to Neudorf, 80 miles; Arcola, Man., to Regina, 112.9 miles; 30 miles northwest of Yorkton, Man., to Shebo 12.2 miles; Labelle, Que., to Nominique, 20.8 miles; total	225.90
Cape Breton—Extension to St. Peters, N. S	20.00
Grand Trunk—Lynden, Ont., to Brantford	4.12
Great Northern of Canada—Montreal, Que., to Joliette	36.20
Intercolonial—Riviere Cuelle, Que., to St. Denis wharf	6.25
Lotbiniere & Megantic—Lyster, Que., to St. Jean	30.00
Mabou & Gulf	5.00
Orford Mountain—Kingsbury to Windsor Mills	7.00
Quebec Southern—St. Francis du lac, Que., to Pierreville	1.00
	687.47

Mexico.

Interoceanic of Mexico—Cuantla to Atencingo	68.00
Kansas City, Mexico & Orient—23 miles east of Chihuahua to 33 miles east, 10 miles; 8 miles east of Topolobampo to 75 miles east, 67 miles; total	77.00
Mexican Central—Lecheria to Sandoval, 17.78 miles; Felles to Pachuca, 10.41 miles; Anita to Honey, 4.40 miles; San Pedro extension, 97.72 miles; total	130.31
Oaxaca & Ejutla—Ocatlan to Kilometer 60	20.00
Parral & Durango—Llano Blanco to Mesa de Saudia	4.35
	299.66

The Necessity for Track Improvement.

BY MAX BARSCHALL.

Bulletin No. 8 of the Interstate Commerce Commission lists 4,476 derailments during the year ending June 30, 1903. Of these, 821 were due to defects of track, and were just 50 per cent. more than happened during the previous year. Undoubtedly these dangerously increasing number of track failures are due to increased loads and speeds without corresponding track strengthening.

Improvements in rolling stock do not require so much time for testing as do those on superstructure, and the managements have been compelled by economy to increase the carrying capacity of the rolling stock, while improvements on track have remained far behind and are still more being delayed by the lack of time and opportunity for maintenance of way engineers to study and practically develop further improvement in construction of tracks. Their reports to the managements fail to work as they are intended to do, and frequently the reports are influenced by apprehensions of being unwelcome if independent and energetic.

On the other hand the serious responsibility for any changes in superstructure weighs on those who have to take the initiative, and there is no need of explaining why they are conservative in staking their reputation and position on improvements not promising immediate returns. The meetings of engineers also have failed to readily secure the necessary progress in superstructure. These and other reasons account for the long way from theory to practice; hence the continued waste of material and labor, as is shown by the use of excessive rail sections wearing out rapidly, by defects due to insufficient jointing and fastening of rails, and last but not least, by the use of untreated cross ties, subjected to early wear and decay. The results are the increasing number of wrecks and frequent disturbances of traffic on account of constant patching and renewing parts of the superstructure, not to speak of the deteriorating influence of such defective tracks on rolling stock.

Although it is impossible to even approximately figure out the loss without statistics of years, it may not be useless to outline an imaginable calculation of what is now being wasted on rails and ties only. Up to date rails are generally serviceable during 10 years on main tracks and 10 years on sidings. Removing them, cutting off their battered ends, loss in length, thereby, repunching bolt holes, relaying and equipment will cause an outlay of

120 tons at $20 per mile	$2,400
Joints, fastenings and laying	600
	$3,000
Interest thereon for 20 years at 4 per cent. = 80 per cent.	2,400
	$5,400
Cost of removal after 10 years, including labor and equipment	800
Interest thereon for 10 years at 4 per cent. = 40 per cent.	320
	$6,520

Divided by 20 years = $326 per mile per year.

With joints and fastenings fully answering the purpose it is generally admitted that at least 25 per cent. of maintenance of rail expenditure will be saved and that rails of good and hard steel will last about 10 years longer, or 30 years, if their ends are protected from disproportionate wear, having equal wear of joints and rails. The cost would amount to

120 tons at $20 per mile	$2,400
Joints, fastenings and laying	600
For improvements thereon add	600
	$3,600
Interest thereon for 30 years at 4 per cent. = 120 per cent.	4,320
Removal to sidings after 15 years with repairs	300
Interest thereon for 15 years at 4 per cent. = 60 per cent.	180
	$8,400

Divided by 30 years = $280 per mile per year, or $46 less than with the present system. Putting with this only $54, as the lessened expense for labor on maintenance of track, there is an ultimate annual saving of $100 per mile.

Untreated cross ties of hard wood, having an average life of 7½ years, including handling, hauling and laying, cost not less than 80c. a piece or per mile of 2,500 ties:

1	Laying $2,000 — interest at 4 per cent. until renewals of rail. 15 years at 4 per cent. = 60 per cent.	$1,200
2.	Laying $2,000 — interest at 4 per cent. until renewal of rails, 7½ years at 4 per cent. = 30 per cent.	600
	Laying $4,000—Interest	$1,800
	Capital.	4,000
		$5,800

Divided by 15 years = $386 per mile per year. Cheaper ties cost still more on account of their shorter life.

As it has been proven by experience that cheaper wood like beech, etc., is better adapted to impregnating, than harder wood, it would, with an inexpensive treatment, not exceed the price of untreated hard-wood ties, and increase the life of soft-wood ties to 15 years or more. The outlay would be

$2,000 + interest at 4 per cent. for 15 years, $1,200, = $3,200;

divided by 15 years = $213 per mile and year, or $173 less than untreated hard wooden ties.

The minimum saving on material and labor would therefore amount to $100 plus $173 or $273 per mile a year, or $54 millions on 200,000 miles of railroad of this country without even considering other savings by means of reduced wear and tear of rolling stock, of reduced number of wrecks and less disturbance of traffic. Savings of this kind, when recognized, will probably lead to improvements in order to secure further increase of carrying capacity at reduced cost.

It is unprofitable to lay new rails on old ties, or new ties under old rails; the strongest tracks at the end are the cheapest; entire renewal after long intervals are giving the largest returns. Some recent proceedings in the tie treating question are indicating a modus to speedily make up for what has been neglected. The Agriculture Department in Washington and a number of leading railroad companies have joined in scientific and practical investigations, aiming at an early decision on the preserving system to be adopted. The rail and joint questions are closely connected to the tie treating question, because the principal purpose consists in not only prolonging but in equalizing the life of ties, rails, joints and fastenings; to further delay improvements on the latter and to lay defective tracks on well treated ties would mean imperfect work.

A railroad from Milan to Varese, built as a steam railroad, has been for some time worked experimentally by electricity. The result has been so favorable that 21 additional motor cars are to be built for it in Milan; and it is said that the time for the run of 40 miles will be only 45 minutes; which, as there must be numerous stops, means high speed between stations. These motor cars are 59 ft. long.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 83 Fulton Street, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

A stimulus to investigation and experiment for getting stronger track has been given by the Berlin-Zossen speed trials, where it has been shown that no ordinary rail joint or track can withstand the stresses made by motor cars at extraordinary speeds. It is a valuable lesson from the picturesque incident. The endurance of track is allied to it, but involves other considerations, those which are set forth generally in an article by Mr. Barschall in another column. The method by which he arrives at the conclusion that $54,000,000 a year are lost on American railroads by the use of untreated ties, and joints which do not protect rail ends, can be easily overhauled and criticized, but it is quite unnecessary to do so. It makes little difference in the lesson whether the loss is half that sum or twice as much. It is a plain fact that here are two great unsolved engineering problems which concern economy and safety, and which should have all the more study and experiment because they are old and because the practice is far behind the accomplishments in other departments of railroading. Track work is a department of engineering in which theoretical improvements are peculiarly apt to fail—they are proved only when tried, and the trials must usually last through a series of years. We have all seen the best-designed joints and apparently the best planned methods go wrong under the time-test. Nevertheless, we are spending more than two billion dollars a year in maintenance of way in this country, and no one will deny that the cost of ties and joints is a large part of this great sum that is ill-spent. Only a few years ago, when a chief engineer asked his president for an allowance for a young bridge engineer's salary, he was rebuked by the statement that bridge work was the most highly scientific part and should be the concern of the head of the department; and the chief engineer answered that the maintenance cost more than $3,000,000 a year, and he hoped by personal attention to either increase its efficiency or decrease its cost by 25 per cent., whereas a better bridge engineer than he ever hoped to be could be got for $1,800 a year.

The derailment at Laurel Run, Penna., on December 23, is notable for its terrible results, for the insignificance of its cause and also that death came swiftly, without prolonged suffering, to the victims. There were few wounded. When the locomotive was derailed by timbers on its track, cast there from a passing freight, the leading passenger car was forced over the baggage car and tender and landed on the engine, where its occupants were boiled by a steam blast from the boiler dome. There is no claim that the engineman was not keeping a good lookout; the engine was a new one and the cars were of approved construction. The fall of the timbers was due to faulty stakes or stake pockets or loading. The rarity of such defects and insecure loading, in comparison with the billions of chances for them, is evidence of the prevailing care in inspection at terminals and of the discipline and thoroughness of the work of car loaders at stations. Their work is subject to the scrutiny of car inspectors at every division terminal; and where a long journey may develop a combination of insecure loading and a defective car, a fault which did not exist at the start, this inspection is the most vital factor; but as other defects in cars have long made it necessary for superintendents to maintain the inspection at the highest possible efficiency, it can hardly be said that this case teaches any new lessons. It is not the results of an accident, it is the cause which should be studied. Two days before the Laurel Run disaster the following accident occurred:

A serious freight wreck occurred at Woodfern as the result of the shifting of iron bridge trusses loaded on a flat car. The beams slipped from their fastenings and swung crosswise of the car as the train was going around a sharp curve at a high rate of speed. A freight train running in the opposite direction crashed into the projecting trusses with a force that derailed and wrecked the engine and piled up 10 freight cars. The engineer and fireman of the wrecked freight had hairbreadth escapes, but were only slightly injured.

Memory is apt to be at fault in comparing the magnitude of a present disaster with those which have occurred before. It is well, therefore, to recall the most most serious ones:

	Killed.	Injured.
1903—Laurel Run, Penna.	65	About 30
1901—Nyack, Mont.	31	..
1900—Tacoma, Wash. (electric car)	40	..
1900—McDonough, Ga.	41	..
1899—Stratford, Conn. (electric car)	29	..
1896—Atlantic City, N. J.	47	50
1895—Kobe, Japan	140	..
1889—Armagh, Ireland	80	262
1888—Mud Run, Penna.	66	..
1887—Chatsworth, Ill.	85	250
1881—Mailpois, Mexico	214	50
1879—Tay Bridge, Scotland	73	None
1876—Ashtabula, Ohio	80	60
1864—Belœil, Canada	83	..
1864—Mast Hope, Penna.	60	120
1856—Camp Hill, Penna.	66	100
1842—Versailles, France	52	40

Only three days after Laurel Run came the butting collision at East Paris, Michigan, in which about 22 were killed and 29 injured. Its lesson is a plain one. The meeting point was ordered changed by the train despatcher and the station agent at McCord's says that his signal lamp was blown out, and the engineman, not expecting an order at this station, ran his train on to destruction. This was human error, for the rule is that when the engineman does not find a light where there ought to be one, he must stop and find out what is the matter; and the duty to know at exactly what place he should find each light is the very first duty that is impressed on him when he learns the road. That light at McCord's should have shown either "stop" or "all-right;" if a light does not show go-ahead it must be taken to indicate "stop." To some railroad men this case will suggest a comparison between the despatching system and the block system. As an engineman made the mistake of passing a fixed stop-signal, would he not do the same under the block system; and therefore are not the usual arguments for the block system overdrawn? Enginemen have run past block signals, exactly like the train-order signal at McCord's, without heeding them. But the block system is far safer because it inculcates a methodical habit of minding and relying on signals which tell him absolutely whether or not he has a clear track. Under the despatching system the old habit persists, of going on unless stopped. Under the block system an engineman, after a few years, if not in a few months, learns to stop unless signaled to go on. This shifting of the burden of proof is one of the great values of the block system. It is not the whole argument, but it is the one that applies with force to a case like this.

Compulsory Block Signaling.

The Interstate Commerce Commission has submitted a draft of a law (printed in full in another column) designed to make it "unlawful to move any car or engine" on any passenger road engaged in interstate commerce, after January 1, 1909, unless under the block system. The Commission defines this system to be "the method whereby, by the use of the telegraph, telephone, or electric bells, or by automatic apparatus, each train is prevented from leaving a certain point until the last preceding train has passed beyond a certain point farther on."

That the public interest is best served by wise governmental regulation of railroads is beyond question. Unrestricted operation and competition by 1,200 railroad operating organizations result in inequalities and injustice just as surely as unrestricted railroad building has resulted in calamity. The expediency of the proposed law, considering the present voluntary progress made in installing block signal systems, can be intelligently judged by a summing up of the results of like legislation in this country and in Great Britain.

The British law of August 30, 1889, authorized the Board of Trade to order the use of the block system and of the interlocking of switch points and signals; but 16 years before that time 39 per cent. of its mileage was already blocked, and in 1889, the year the law was passed, all of the double track lines in Scotland were worked by the block system; in England 98 per cent., and in Ireland 35 per cent. One year later the mileage of single track worked by the block system was about 90 per cent. of the whole. By 1898 substantially the whole of the passenger lines of the United Kingdom were block signaled and practically all switches and crossings were interlocked. The British block system was, and still is, purely manual, costly to maintain and always subject to human error; although on some congested lines the controlled manual is used.

In 1893 the Interstate Commerce Commission was empowered by law to compel the use of automatic couplers and power brakes on cars used in interstate commerce, but a year before this time 17 per cent. of all the freight cars in the country were equipped with automatic couplers, and 12 per cent. with air brakes. The provisions of the law of 1893 were to have gone into effect on Jan. 1, 1898. On that date the roads reporting to the American Railway Association had 61 per cent. of their cars equipped with automatic couplers and 41 per cent. with air brakes. Owing to the depression in business throughout the five years 1893-1898, the date for compliance was postponed by the Interstate Commerce Commission, in accordance with the provisions of the Act, and the requirements of the law finally went into effect in August, 1900. The statistics for that year show 93 per cent. of the freight cars equipped with couplers and 64 per cent. with air brakes. In regard to air brakes the law did not specifically require the equipment of any fixed number or proportion of cars, but required the use in every interstate train of enough power brakes to control the speed, hence 64 per cent. was a practical compliance with the Act. On July 1, 1903, the percentage of freight cars equipped with air brakes was 81.9.

It is a grave question whether the constitutional grant to Congress, "to regulate commerce . . . among the several States," gives a right to make it unlawful to move a passenger train anywhere on a line between Chicago and Omaha unless it is at each step "prevented from leaving a certain point until the last preceding train has passed beyond a certain point farther on." The courts have already interpreted this clause as giving to Congress the right to prescribe rules for the equipment of cars crossing State lines with appliances for safety and interchangeability. Mature people easily recall their surprise when, only a few years ago, this deduction was made from a clause in the constitution primarily designed to prevent the exaction of duties at State lines. Not many years before that the State of New Jersey was taxing passengers between New York and Philadelphia one dollar each, and no one seems to have thought of the power given to Congress to prevent such a "restraint of trade."

The control by the general government of methods of transportation within a State has never before been attempted, and this prescription of definite rules for installations and operations, wholly within a State, if found to be lawful, will have other results which seem to be logical. It may be found to be a restraint of trade to move passengers at other than high speed on roads crossing State lines. The motive power to be used, the safety of bridges and track, may likewise be made subject to general government supervision. Nevertheless, this need not be at all alarming. The tendency of court interpretations of general authority conferred by the constitution of the United States and the several States has always been toward the broadening of those interpretations—to their specific application to every case which the words used may fairly cover. It may reasonably be expected—with some doubt—that if this bill becomes a law it will be upheld. The doubt is

rather whether or not the members of Congress may consider such a law an infringement on State rights.

But is this law designed to promote the public welfare? In the history of railroading no public enactment has ever pointed the way. Betterments have invariably been found, perfected and applied by the men whose business it is to make transportation, and it happens that the function of the lawmaker has never been advantageously applied to compulsory use until after the substantial perfection and long continued voluntary use of the devices for betterment. Mr. Westinghouse needed nearly twenty years to fully develop the quick-acting automatic air brake, the only discovered means of controlling long freight trains at high speeds. In its earlier forms it was applied without compulsion to most passenger trains. From 1888, when it was so improved as to be usable on long freight trains, its application was voluntarily made with wonderful rapidity. The safety appliance law was, later, of use only in enforcing action by a minority of recalcitrants.

Block signaling is of two kinds, safe and much less safe. No system is fully safe without a track circuit, which is somewhat difficult to satisfactorily apply to single track roads, and the first cost of which is not justified on lines of very thin traffic. Nevertheless, it has been installed and is working well on many hundred miles of busy single-track lines. It is believed to be desirable both for reasons of safety and of economical increase of capacity on most double-track roads. It has been for years a progressive art, and its latest developments have been put in service quite as fast as they should be. The criticism is, rather, that of too great eagerness to put in service untried devices.

The sum of it is that automatic block signals are now available for getting a greater measure of safety, a greater capacity (in that they make it practicable to run more trains safely) and a lower cost of operation than the manual system; and the railroads are showing a disposition to install and use them as fast as possible.

President Mellen, of the New York, New Haven & Hartford Railroad Company, has, we understand, been looking carefully into the marine department of his corporation with a view to future economies and possible changes in the operation of that important branch of the company's service. The fact suggests that the great boat traffic of Long Island Sound, now almost monopolized by the New Haven railroad company, has been fiscally almost a sealed book to stockholders as well as the public. The corporation owns or controls six important boat lines between New York city and Bridgeport, New Haven, New London (and Norwich), Stonington, Providence and Fall River. It has a great fleet of large Sound boats, very valuable wharf properties and gross receipts from traffic running probably well up into the millions—saying nothing of transfer floating stock in New York waters which includes four steamers, 15 tugs and 41 car floats. Yet practically the only references in annual reports to the great Sound traffic of the corporation have been, for example, such curt allusion as appears in the last report where it is stated that "The earnings of steamboat lines are not included in the foregoing figures (the general statement) except that the dividends received from the lines are included in the item 'Income from other sources'" ($565,817). The marine department is an integral and very large factor in the New Haven system, and if President Mellen in his first report next autumn sees his way clear to letting in light upon the old *arcanum* it will be a subject in which the general public as well as his shareholders will take much interest. In this connection it may be recalled that, on motion of a stockholder, President S. D. Babcock, of the old New York, Providence & Boston Railroad, made the returns of the controlled Stonington steamboat line a separate part of the annual railroad statement, where it figured, if we are not mistaken, until both were absorbed by the New Haven system.

The Supreme Court of the United States, in a decision by Justice Day, has upheld the rule of the Courts of the State of Pennsylvania which forbids a common carrier to limit its liability for damages due to negligence; and the fact that a shipment is interstate does not alter the application of this rule. The decision, which was in a suit brought by Hughes & Fleming against the Pennsylvania Railroad, and was handed down December 7, appears to be little more than a restatement of opinions by the Supreme Court in an Iowa case, Chicago, Milwaukee & St. Paul vs. Solan (169 U. S. 133); the difference between Iowa and Pennsylvania being that Iowa enacted a statute, while in Pennsylvania the rule was enunciated by the Courts, there being no statute on the subject. Hughes & Fleming had a horse shipped from Albany, N. Y., to Cynwyd, Pa., and the animal was injured by negligence in switching, in a Pennsylvania yard, at Philadelphia. In the bill of lading the liability of the carrier was limited to $100, in consideration of a low rate. The law of the State of New York permits this kind of contract, and the same rule is recognized in the Courts of the United States; but in Pennsylvania, although there is no statute prohibiting agreed valuations, the Courts hold that such agreements are contrary to public policy. The owners of the horse claimed that the action of the Pennsylvania Courts was contrary to the Interstate Commerce Law, and on that plea they got the case before the Supreme Court. The decision quotes a number of earlier decisions sustaining the view that a State may, under the Federal Constitution, require a common carrier, although in the execution of a contract for interstate carriage, to use great care and diligence, and be liable for the whole loss resulting from neglect to use such care and diligence; and the principle is the same whether the State exerts this control by means of a statute or by the rulings of its Courts.

The Erie Railroad has doubled the capacity of its line leading to the terminal at Jersey City, for one hour each morning, by a stroke of the pen; that is, by ordering the use of both of the two main tracks for eastbound trains. This line, the approach to the company's New York terminal, accommodating the trains of the main line, the Newark branch, the Northern Railroad of New Jersey, the New Jersey & New York, and the New York & Greenwood Lake, has long been congested morning and evening because of the limitations of the tunnel. The construction of additional tracks would be very costly and the dividing of the tunnel into two block signal sections is objectionable. The difficulties have been somewhat mitigated by coupling two short passenger trains together and running them through the tunnel as one train, but the benefits from this arrangement are quite limited. Under the new arrangement there will be no westbound trains at all between 8 and 9 a.m. Trains which formerly left soon after 8 are made to go earlier, and those which left shortly before 9 will go later; and five local trains have been taken off or consolidated with others. On the last train going west before 8 o'clock, which is No. 21, leaving the terminal at 7.47 a.m., a train despatcher rides from Jersey City to the station at the west end of the tunnel; and during the hour that trains are detoured this officer gives a hand signal to each engineman who is to run on the left-hand track. The length of the line is about two miles. This hand signal is in addition to the usual fixed signals. In the order putting the regulation into effect the despatcher is named, and the hand signal must not be taken from any other person. In case of his disability, the superintendent will make suitable announcement of the name of the substitute.

On the Chicago & Alton all of the coal used by the locomotives is now weighed out to each individual engine. Measurements, as substitutes for scale weights, have been done away with, and the records of coal delivered to tenders are now kept with such accuracy that these figures alone are used to check the weights given by the mines, obviating the necessity of weighing the cars on the road. At all of the principal coaling stations, coal conveyors and scales are provided so that this work is, of course, easy; and at other places, such as the termini of branches on which but few trains are run, and where the coal is delivered directly to the tenders from the cars which bring it from the mines, the desired precision is secured by the use of cars fitted with partitions. Thus at a station where only two engines come to get their supplies, the coal is sent from the mine in a car having a partition in the middle, and, as a given engine uses all of the coal in a given section of a car, the need of weighing each tender-full is obviated. An officer of the road informs us that this method of keeping the records has proved highly satisfactory. It is found that enginemen and firemen, knowing that the charges against them for fuel are made with precision, take better care to show economical use of the coal.

NEW PUBLICATIONS.

History of American Steam Navigation. By John H. Morrison. 1903. Published by W. F. Sametz & Co., New York. 637 pages, 6 x 9 in., cloth. Price $4, postage 25 cents extra.

Mr. Morrison's book is the most nearly unique history of American steam navigation which has ever been published, not only on account of the careful and accurate knowledge which it contains, but also because of the personal style in which it is written. The book has been 20 years in preparation and the author has collected a surprising mass of data in regard to his subject, going into the most minute detail and printing many of his documentary sources of information in full. The book might be called gossipy in that it gives the reader a kind of personal acquaintance with the steamboats of the '60s, the '50s, the '40s and the '30s, as if he himself had stood on the pier head and seen them go up and down the stream on their regular runs. All American commercial steam navigation is covered, classified primarily with respect to the geographical field; as, for example, the Hudson River, Long Island Sound, or the coastwise service; but also by cities. Thus, within the general Long Island Sound classification a complete record is given of all the passenger steamboats which have ever run between New York and New Haven, between New York and Norwich, Fall River, etc. The book is exceedingly graphic for the reason that the author does not spare space when he has interesting matter to tell, and we read of the burning of the "Lexington" on Long Island Sound in 1840 at midwinter with as much excitement as if it were in our morning paper. There is a full and complete history of each of the Sound lines, not only those at present in operation but those which have died out, and the little circumstantial incidents about hulls, boilers and captains, so often omitted as unimportant in a history work, make the book quite charming to those interested in the subject. Chapter 4, containing about 50 of the large pages, is devoted to the western rivers and is one of the most fascinating parts of the book. The hopelessly reckless way in which the boats were built and run stands out graphically on every page. For example, quoting from a passage in the book where David Stevenson, in 1838, is writing of his experiences in making a landing on the Mississippi: "She (the steamer 'Ontario') was sheered close in shore amongst stones and stumps of trees, where she lay for some hours taking in goods. The additional weight increased her draft of water and caused her to heel a great deal, and when her engines were put in motion she actually crawled into deep water on her paddle wheels. The steam had been got up to an enormous pressure to enable her to get off and the volumes of steam discharged from the escapement pipe at every half stroke of the piston made a sharp sound almost like the discharge of firearms, while every timber in the vessel seemed to tremble and the whole structure actually groaned under the shocks." The writer evidently was greatly interested in the racing which used to play such an important part in water transportation, and there are many thrilling episodes related with the fullness of circumstance and vividness of picture that one would get from a group of sea-faring men who had been on the scene. Many errors of previous historians are corrected with a mass of evidence, and but little regard has been paid to the traditions of historians who have previously written on the subject. Mr. Morrison was with Samuel Secor, a marine engineer of Washington street, New York, during the early '60s, and with C. W. Copeland, marine engineer, New York, from 1873 to about 1890; so he writes of the steamboats which plied in eastern waters as of old friends, and his book is cordially recommended to those who are interested as by far the most complete and interesting document of its kind that we have seen.

TRADE CATALOGUES.

Gas for Furnace Work is the title of a small pamphlet published by the Power & Mining Machinery Co., New York, in which are given some interesting data on the comparative cost of operating oil and gas fired furnaces for annealing, forging, welding and melting. The figures are taken from plants in actual operation; the cost of producer gas as fired being calculated on the performance of Loomis-Pettibone gas producers which are made by this company. Bituminous or anthracite coal, coke or wood can be burned without any modification of the apparatus and a clean fixed gas is produced which can be conveyed any desired distance in cast or wrought-iron pipes. The Power & Mining Machinery Co. also makes the Crossley gas engines in sizes from 150 h.p. to 650 h.p.

"Continental" Boilers with Morison corrugated furnaces is the subject of Ryerson's new technical library, sixth edition, No. 4, issued by Joseph T. Ryerson & Son, Chicago. This type of furnace together with typical installations are described in detail. A chapter on "The True Tale Tersely Told" gives interesting comparisons between horizontal tubular and internally fired boilers. A test of a Morison corrugated furnace boiler at the Central Park Avenue station of the Chicago Water Works showed that the equivalent evaporation per pound of coal was 12.44 lbs.

Westinghouse Electric & Mfg. Co., Pittsburg, Pa., has issued two revised circulars dated December, 1903, and superseding previous publications on the same subjects. Circular No. 1,032 describes the No. 56 railroad motor, made by this company, which is suitable for city and suburban cars. These machines have a rated capacity of 55 h.p. Electric Motor-Vehicle Equipments is the title of the other circular, which is numbered No. 1,059. The equipment supplied for one vehicle includes the motors, controlling devices and wiring but does not include the storage batteries.

The Keystone Driller Company, Beaver Falls, Pa., has sent us catalogues Nos. 1 and 2 together with illustrated circulars containing testimonials from users of their machines. Catalogue No. 1 has 88 pages devoted to portable drilling machines and accessories. It also contains valuable suggestions on the handling of drilling outfits. Catalogue No. 2 is entitled "Mineral Prospecting Machines," and shows the adaptations of the drilling outfits to prospecting.

The American Brake-Shoe & Foundry Company, Mahwah, N. J., has issued catalogue No. 2, which gives illustrations and prices of engineer's wrenches, "S" car wrenches, track wrenches, coal picks, car repairer hammers, and machinists' hammers. These cast steel tools are made by the Tropenas converter process.

The January number of *Graphite*, published by the Joseph Dixon Crucible Co., Jersey City, N. J., contains the usual series of miscellaneous amusing anecdotes, judiciously interspersed with stories which point a moral.

The Railroad Around the Falls of the Madeira River, Brazil.

BY O. F. NICHOLS.

It is announced in the press despatches that in a recent treaty between Brazil and Bolivia relative to the northern boundary of Bolivia, Brazil agrees to build a railroad around the Falls of the Madeira River, and admits the perpetual rights of Bolivia to utilize this great route to the Atlantic. Bolivia has an area of nearly 600,000 square miles, more than half of which, in the northern portion of the republic, is less than 5,000 ft. in elevation above the sea. This section is traversed by numerous rivers, many of them navigable for vessels of good size and generally embraced in the systems of the Madre-de-Dios, Beni, Mamoré and Guaporé, which join near the northern boundary of Bolivia to form the Madeira River, which, 900 miles further north, joins the Amazon at about 900 miles from its mouth.

The section of northern Bolivia referred to, though partly developed for more than 200 years, is still partly undiscovered and very sparsely populated. Its climate and soil permit the cultivation of the products of the temperate as well as the tropical zones; wild cattle roam its upland plains, cinchona trees are abundant in its upland forests, and rubber trees in the dense growths of its tropical river bottoms. The natural outlet to this district is by way of the Madeira and the Amazon to the Atlantic ocean. The Amazon is navigable for ocean vessels to the mouth of the Madeira, and the Madeira is navigable for such vessels for nine months of the year, and all the time for vessels of eight feet draft as far as San Antonio, 600 miles from its mouth. At San Antonio the Falls of the Madeira begin and extend over a distance of 229 miles, in which distance there are 19 distinct falls or rapids, with a total fall of the river in this distance of 272 ft.; the length of broken water in the range of the falls is 12.2 miles; most of the rapids are less than 1,000 ft. in length, but several of them have a length exceeding one-half mile, while the four actual falls have the following dimensions, taken in order southerly from San Antonio:

Theotonio	24.6 ft.	fall in	984 ft.
Girao	26.24 ft.	"	2,296 ft.
Riberiao	13.45 ft.	"	1,312 ft.
Bananeiras	19.68 ft.	"	1,640 ft.

In 1779, Thaddeus Haénke, the celebrated naturalist, was commissioned by his Catholic majesty to explore Peru. He offered to undertake the opening of navigation down the Mamoré, the Madeira and the Amazon, and pointed out the vast treasures lying dormant in the present Bolivia, and the commercial benefits that would result from their transfer to Europe by this route.

In 1844 Señor Jose Augustin Palacios, a Bolivian engineer, was instructed by the government to examine the Department of the Beni and to explore the rapids of the Madeira. Writing of the rapids he says "This inconvenience is one that might easily be surmounted."

In 1853 Lieutenant Lardner Gibbon, U. S. N., explored the Madeira. His party was 12 days descending the falls. He reports that a Bolivian party were five months making the same distance with cargo in small boats in the opposite direction, and that a common mule road cut straight through the territory would not exceed 180 miles in length and could be traversed in about seven days.

In 1861 General Quintin Quevedo, of Bolivia, descended the rapids and suggested the canalizing of the inaccessible places, or the establishment of lines of steamers to act in conjunction with a railroad around the falls.

When the boundary line treaty was made between Brazil and Bolivia in 1867-8, Brazil sent José and Francisco Keller, German engineers, to make a thorough examination of the rapids of the Madeira and report upon the best method of avoiding them. They estimated the cost of inclined planes at the several rapids at $450,000; the cost of a canal with 24 locks and a depth of water of about six feet, at $10,500,000; the cost of a macadamized road with a width of 19.7 ft. at $2,850,000; and the construction of a railroad at $4,250,000.

On Dec. 7, 1869, Colonel George Earle Church obtained a concession from the Government of Bolivia granting to the National Bolivian Navigation Company, among other valuable privileges, the exclusive right to navigate the rivers of Bolivia, affluents of the Madeira. The company agreed to canalize the rapids but the Government agreed that if it be found that it is more appropriate to make the transit of the rapids by means of a railroad "that this shall be done." In 1870 an act was passed in the Congress of the United States incorporating the National Bolivian Navigation Company with a capital of $1,000,000, the company having power to secure steam or other vessels and employ the same in navigation between the United States and the ports of South America, or upon the rivers and navigable waters of Bolivia and Brazil.

In April, 1870, Col. Church obtained a concession from the Government of Brazil granting the exclusive privileges for the term of 50 years for building a railroad which avoids the falls or rapids of the Madeira and Mamoré Rivers. This concession authorized the organization of the Madeira and Mamoré railroad and granted the company large tracts of land, mining privileges and the right to canalize the rapids, if necessary.

In August, 1871, the Bolivian Congress provided for a loan of £1,700,000 to be placed in Europe, 83 per cent. of the proceeds of which were to be given to the National Bolivian Navigation Company for the purpose of executing the concession granted by Bolivia. This loan was placed in Europe by Messrs. Erlanger at about 65 and the net proceeds placed in the hands of trustees in London to be used as required in the execution of the works. Subsequently a further concession was granted by Brazil guaranteeing the payment of 7 per cent. interest on debentures of the railroad company to be issued in case the Bolivian fund was not sufficient to complete the railroad.

The railroad company was incorporated in London with Col. Church as chairman, but this company was practically owned by the Navigation Company, whose stockholders were all Americans. On Jan. 19, 1872, a contract was made with the Public Works Construction Company of London, to which both the railroad and the navigation companies were parties, at a lump sum price of £600,000, for the completion and equipment of the railroad. The contractors shipped a considerable quantity of tools and materials to San Antonio, but they did no work and made no surveys of any value and virtually abandoned the work in 1873. This contract was canceled by mutual consent and efforts were subsequently made to secure other contractors in Europe but without success.

In October, 1877, a contract was made between the navigation company, the railroad company and Messrs. P. & T. Collins, of Philadelphia, Pa., for the survey and construction of the railroad for the sum of £5,900 per mile up to a length of 180 miles. Partial payments were to be made at schedule prices for the work done and material furnished, but the lump sum price resulting from the figures above given was not to be increased unless the length of the line exceeded 180 miles.

The contractors commenced work with much vigor. In February, 1878, the steamer "Mercidita," with a large force of men, a number of engineers and a goodly cargo of supplies, arrived at San Antonio. The town site of San Antonio, which had become overgrown with rank vegetation, since the departure of the former contractors, was cleared up and buildings were built for the accommodation of men and materials. A second steamer, the "Metropolis," left Philadelphia for Brazil,

Route of Railroad Around the Falls of the Madeira.

but sprung a leak and was wrecked at Cape Hatteras with considerable loss of life. A third steamer, the "City of Richmond," of the Old Dominion Line, was despatched from Philadelphia and reached San Antonio in March, 1878. She carried general supplies, some 400 tons of rails and about 400 workmen. Thomas Collins himself went to Brazil on this steamer, and on his arrival the work of building the railroad began, the surveys having been completed for several miles before this time. The resident engineer of the railroad company, who was the sole representative of the company on the work, and who held power of attorney for the company in the Department of Amazonas, also sailed on the "Richmond." During the months of April, May and June, 1878, a great deal of work was done and estimates for this work were duly certified for payment from the trust fund in London. This fund then amounted to about £800,000, and was deposited in the Bank of England. As soon as demand was made for payment for work done the suit of Wilson versus Church was instituted in the Chancery Division of the English courts asking that the construction of the railroad be declared impracticable; that the trustees of the fund be restrained by injunction from paying out any of the money, and that the fund be distributed among the holders of the Bolivian bonds. Litigation in the English courts had resulted from the first contract and from two other efforts to contract for the work, holding the matter in court almost continuously from 1874 to 1878. In 1877 the Bolivian Government, under the influence of the bondholders, relinquished its claim to the trust fund and now became a party to the new litigation for the distribution of the fund. The suit of Wilson vs. Church was commenced in April, 1878, and on June 20, 1879, the Lords Justices of Appeal reversed the decision of the lower court and decided in favor of Wilson and the bondholders. Subsequently the House of Lords, on final appeal, confirmed this decision and the fund was distributed as desired. Col. Church afterwards secured the revokal of the Brazilian concessions, so that since 1880 there has been no existing privilege to build the railroad around the Falls of the Madeira, and no funds applicable for the purpose.

Deprived of payment for work actually done and material furnished, the Messrs. Collins were left in bad condition in Brazil. Their means had not been large and the work had been started on a lavish scale and unfortunately without due precaution as to the conditions of the climate and locality and for the protection of the men employed. Few if any of the men were ever fully paid for work done. The food supplied was unfit and inadequate and none of the men in actual charge of the construction had ever had any experience in the tropics. From July to December, 1878, the men deserted and got down the river as quickly as possible; by the end of the year nearly all of them had gone and the work was practically abandoned.

Improper food, hardship and privation added to the unhealthy conditions of the district about the falls resulted in a larger proportion of deaths and a greater amount of illness than was ever anticipated, and added materially to the discouragements due to stoppage of work and of pay. There probably never was an expedition of similar character conducted on a foreign soil with less knowledge of the peculiar but fixed conditions of the country or with less effort to obtain this knowledge.

The contractors sent out something like 60 engineers, representing the best families and the best professional experience of eastern Pennsylvania, and some of the most energetic and skilful of the railroad builders of that State were of the party to direct the work. Nearly 70 miles of the line were carefully surveyed and over this distance a projected location was completed. A preliminary reconnaisance was extended over 60 miles more of the line and these surveys demonstrated that it is perfectly practicable to build such a railroad. After a little heavy work on leaving San Antonio the line ran on the higher ground away from the river and generally traversed a rolling country without much rock or heavy excavation and could certainly be built at very reasonable cost for work in the tropics. The local climatic conditions, however, will seriously increase the cost, and it is not probable that the line can be completed for less than $10,000,000. The contractors actually completed the preliminary construction for about five miles, involving the heavy work before mentioned. The excavation was generally free from rock and in a clayey loam or compact soil easy to handle, and there were few bridges of any importance.

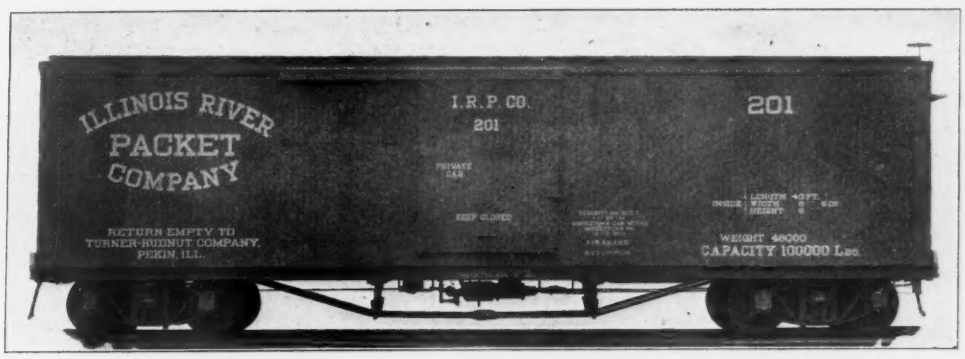
On both sides of the river and the tributary streams rubber trees are very abundant, and the only inhabitants of the district are Bolivians, who collect rubber and transport it by canoes to San Antonio and thence by river steamers to Para. The Beni and Madre de Dios Rivers have never been explored but are known to be rich in rubber and cinchona. The Bolivian rubber gatherers manage to live very comfortably in this section though the life is semi-barbaric. They were generous to a fault to the poor fellows of the Collins expedition who at the same time were suffering from scurvy and dying of fevers, largely for the want of vegetable foods in the midst of a district dense with tropical vegetation.

The history of the Collins expedition will one day be written and it should in any event serve to tone down our American arrogance and self-conceit and tend to educate us as to the difficulties of work by the Anglo-Saxon races in the tropics and the necessity for studying the local conditions in such districts, and to the importance of meeting these conditions with judgment and skill based on the experience of those who have gone there before and established the right to instruct.

As a result of the war with Chili in 1890 Bolivia lost about 35,000 square miles of territory on the Pacific coast, as well as all her seaports; incurred an enormous increase of debt and finds it necessary to receive all her imports from abroad through Chilian and Peruvian ports with excessive customs charges paid to these countries. She has thus learned something, it is to be hoped, as to her isolated condition and the desirability of developing the logical and historical outlet by the Madeira and the Amazon. Brazil is now also a republic and the reported settlement of the boundary disputes between these countries which originated in the ancient ani-

mosity between Spain and Portugal, indicates a broader statesmanship in both countries and encourages the hope that they will be able to work together satisfactorily for the development of the vast and wealthy districts of the Beni in Bolivia and Mato Grosso in Brazil, traversed by the rivers which unite to form the Madeira and which cannot be advantageously developed excepting by the route to the Atlantic by way of the Madeira and the Amazon.

If Brazil has now guaranteed to Bolivia the perpetual right to utilize this route and will build the railroad around the Falls of the Madeira and so improve the rivers as to make them as navigable as the world has a right to expect, the future for the great interior districts of Bolivia and Brazil is assured, and we may reasonably expect a development of this district which has been predicted and expected for nearly 300 years.



Fifty-Ton Steel Underframe Box Car for the Illinois River Packet Co.

50-Ton Steel Underframe Box Car.

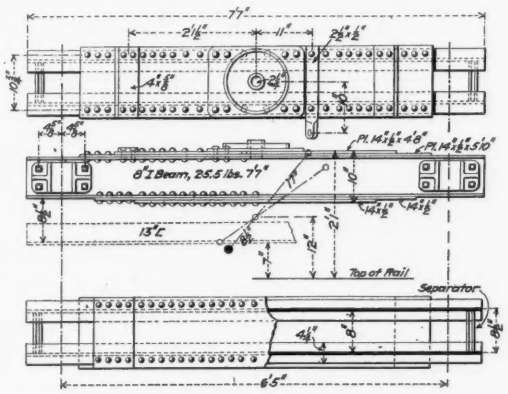
The Middletown Car Works, Middletown, Pa., has recently completed five box cars of unusual design for the Illinois River Packet Co. (Turner-Hudnut Co., Pekin, Ill.). These cars, which are intended for grain traffic, are of 50-tons capacity and are built with structural steel underframe, strengthened with truss rods. The car body is 40 ft. long inside and the whole car weighs 48,000 lbs., which is not excessive when compared, for instance, to the weight of the Pennsylvania's standard 30-ft. box car, which is between 44,000 lbs. and 45,000 lbs.

The accompanying illustrations show the general appearance and the details of construction of these cars. The most interesting feature about them is the underframe on which patents covering its construction were granted, August 18, 1903, to Mr. George I. King, Vice-President and General Manager of the car works. The illustration from the photograph gives, perhaps, the best idea of the arrangement and proportions of the members of the underframe. All four sills are made of 15-in., 33-lb. channels, continuous from end sill to end sill. The two center sill channels are placed back to back, 18 in. apart, and between the bolsters they are latticed on top with double latticing to give additional strength as a column in compression. Five cross ties of 9-in., 13.25 lb. channels are built in around the sills and on these, the 4-in.x 4-in. floor nailing strips are carried. Brackets of Z-shape are riveted on the outside of the side sills to support the side welding strips which are 3⅞ in. x 8 in. Two 2-in. truss rods are placed under the car. They are fastened at the bolsters with a pin connection and bear on posts riveted to the I-beam needle beams which run across the car under the sills and are inclined out of a vertical position, normal to the axis of the truss rods at the bend.

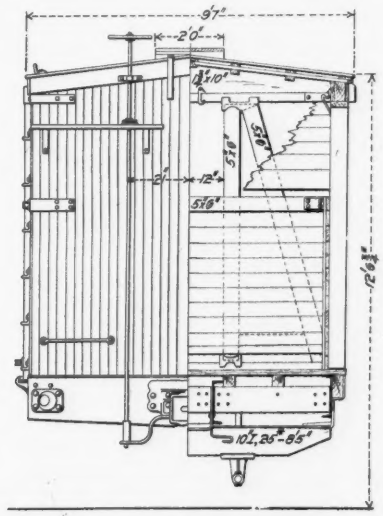
The end sill is a heavy plate, bent to a Z-shape, with the web somewhat deeper at the center than at the ends. A heavy casting riveted on the outside face of the end sill protects the framing from the effects of blows of the coupler horn under heavy shocks. The body bolster is shown in detail in the drawings. It is made of four plates and two angles with a filler casting between the center sills. The top and bottom plates are formed around the center sills and brought together and bent down to rivet through the web and top flange of the side sill. A light diagonal brace, 6 in. x ¾ in., is built in between the two main members to help support the load on the side bearings. Further strengthening against bending of the bottom plate is secured by riveting a 3-in. x 2½-in. x¼-in. angle on the top side of the plate. A large apron or cover plate is riveted to the center sills and the bolster to prevent buckling of the sills just back of the draft gear cheek plates, which are secured directly to the main members of the underframe.

The body framing of the car is strong and substantial. The side posts and braces are 3 in. x 6 in., and the girth is 4 in. x 5 in., but in the end construction 5-in. x 6-in. posts, braces and girths are used to give additional strength against bulging or breaking out under a shifting load. The post pockets follow closely the designs recommended by the M. C. B. Association committee.

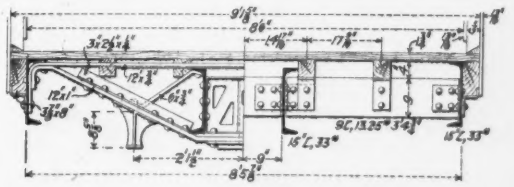
The cars are mounted on arch bar trucks in which a special design of truck bolster is used. The bolsters, shown in detail in the illustrations, are made of two 8-in.,



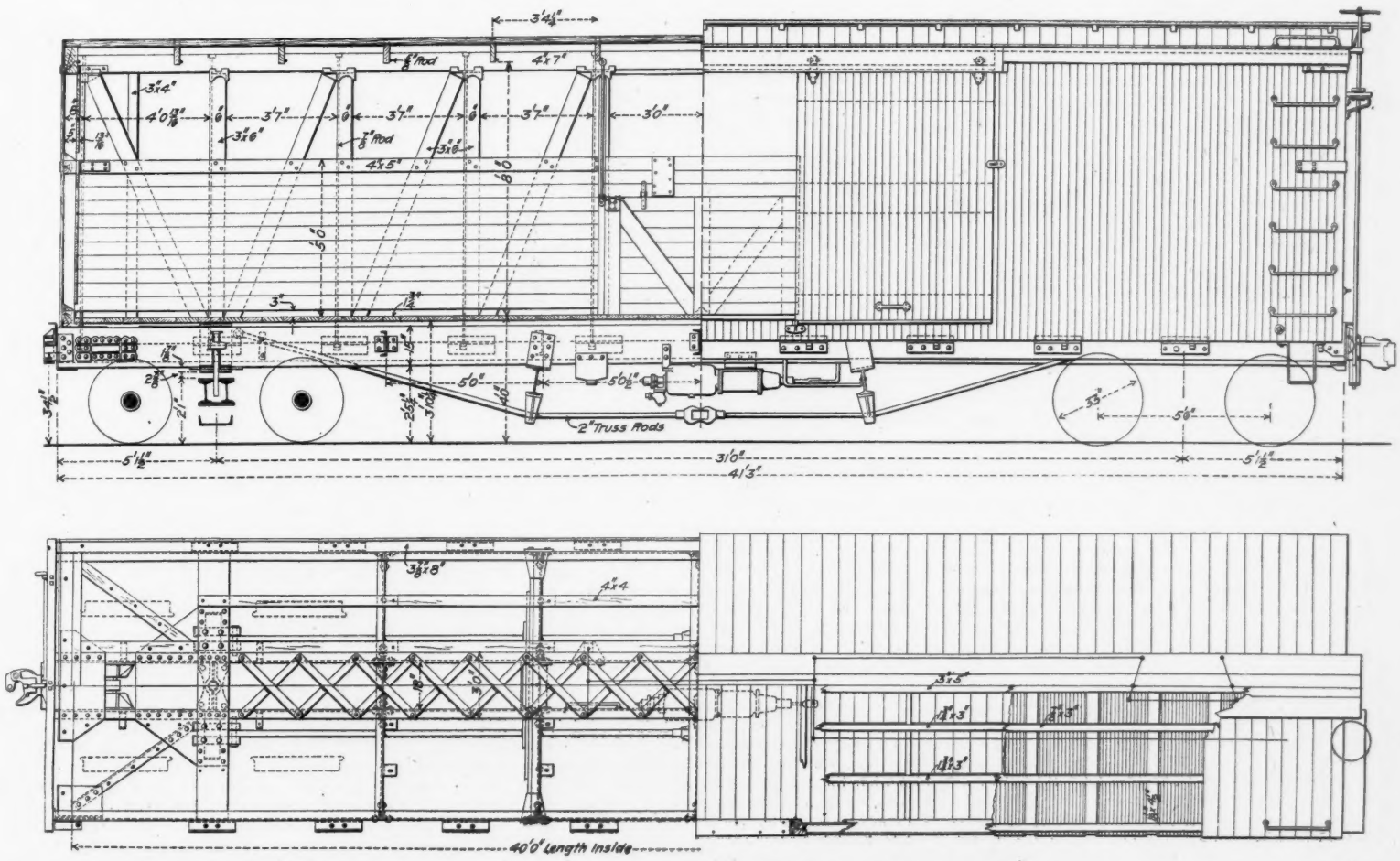
Detail of Truck Bolster.



Half End Elevation and Cross-Section.



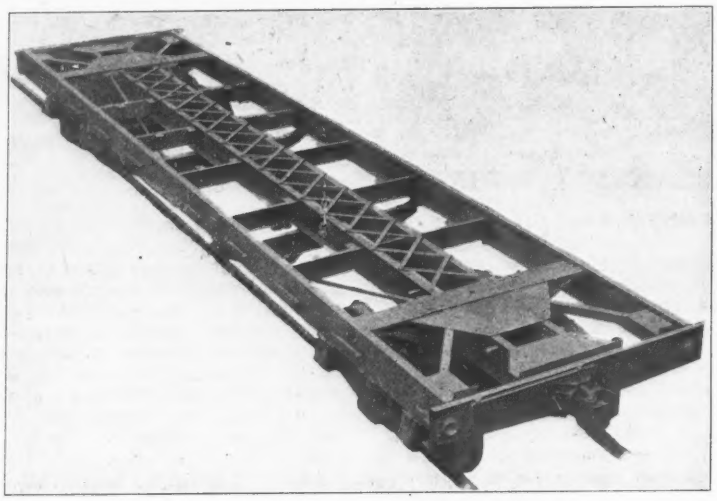
Detail of Bolster and Cross Tie.



Plan and Elevation of Steel Underframe Box Car for the Illinois River Packet Company.

25.5-lb. I-beams tied together with double top and bottom cover plates ½ in. thick. There are no complicated parts in the truck or underframe construction, all of the members being made of standard shapes which may be obtained from any structural shop, making any repairs to the car, if needed, a comparatively simple matter.

We are indebted to Mr. George I. King, who designed the car, for the drawings and information. Mr. King was also the designer of a steel frame box car illustrated and described in the *Railroad Gazette*, Dec. 19, 1902, p. 967, which is similar in many respects to the one shown here, this latest design being largely developed from the earlier one.



Perspective View of Completed Underframe.

Application of Air Motors to Jib Cranes.

A cheap and effective means of changing jib cranes from hand to power operation is shown in the accompanying illustrations. Fig. 1 shows an unloading jib crane in a railroad yard, formerly operated with cranks by two men. To change it to a power crane, the cranks were removed and a Dake air motor was bolted to the side of the mast without changing the gearing. In designing new jib cranes the arrangement shown in Fig. 2 is used. The motor can be bolted to the mast of any jib crane, and will raise and lower the load. The single drum hoist is only for raising and lowering the loads. If it is desired to rack the load on the boom or raise and lower the boom, in addition to raising and lowering the load, a double drum hoist is used. Blue prints or any desired information regarding this arrangement can be obtained from the Holland Company, Chicago.

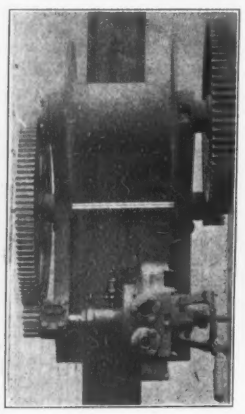


Fig. 1.

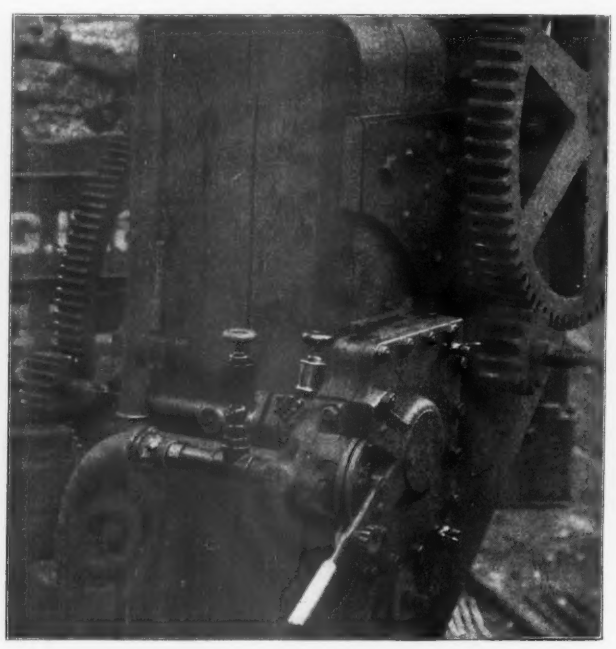


Fig. 2.

Dake Motor Applied to Jib Crane.

Compulsory Block Signaling.

The Interstate Commerce Commission submits with its report the following draft of a proposed law:

That the Interstate Commerce Commission, hereinafter referred to as the Commission, may order any common carrier engaged in interstate commerce by railroad, or owning or operating a railroad in any territory or in the District of Columbia, to adopt the block system on one-fourth part (in length) of its passenger lines, within a time specified; the order to be issued and published two years at least before the date specified for its fulfilment.

Sec. 2. That the Commission, as aforesaid, may order such carrier to adopt the block system on one-half part of its passenger lines within a time specified, the date for fulfilment to be at least one year later than the date for fulfilment of the order to the same carrier authorized by the preceding section; and the order to be issued at least 18 months before the date specified for its fulfilment.

Sec. 3. That the Commission, as aforesaid, may order such carrier to adopt the block system on three-fourths part of its passenger lines; and subsequently on the whole of such lines, within reasonable times; the intent of this section being (1) to require the gradual adoption of the block system and (2) to require its adoption throughout all passenger lines by the first day of January, nineteen hundred and nine.

Sec. 4. That in respect of any passenger line, whether it be the whole or a part of a company's line or lines, on which the receipts from carriage of passengers, express traffic and United States mails shall for two years have aggregated $1,500 per mile per annum, or more, as shown by the records of the carrier, the Commission as aforesaid may order and require the adoption and use of the block system throughout the line by Jan. 1, 1907, due regard being had to the principle of gradual introduction, as embodied in Sections 1, 2 and 3.

Sec. 5. That in respect of passenger lines on which the receipts from all traffic, passenger, express, United States mails, and freight, shall for two years have aggregated $3,000 per mile per annum, or more, as aforesaid, the Commission may order and require the adoption and use of the block system as in the preceding section.

Sec. 6. That for the purposes of Sections 4 and 5 the Commission may require from any carrier a report, annually, of its receipts from the carriage of passengers, from express traffic, from United States mails, and from freight, in which the sums pertaining to the different divisions of the railroad, as defined by the Commission, shall be shown separately; such report or reports to be made and filed in accordance with the rules and requirements governing the making and filing of carriers' annual reports. The Commission shall not make arbitrary and unreasonable divisions of a railroad; and may require, accept and use approximate statements of receipts for any period previous to July 1, 1904.

Sec. 7. That for the purposes of this act the Commission may require every common carrier affected by the act to seasonably file at the office of the Commission in Washington a plan or plans, sketch or sketches, showing all of its main tracks, and the situation of all side tracks connected directly to main tracks, cross-overs, switches in main tracks, crossings, drawbridges, derailing switches, fixed signals, signal towers or cabins, station buildings, highway crossings, bridges (supporting tracks), overbridges, water stations and coaling stations; such plans or sketches to be drawn to as small a scale as is practicable consistent with their purpose, and to have the aforesaid features suitably and clearly indicated and described by words or abbreviations; and to have memoranda showing what, if any, main tracks are used for freight traffic only; and to be accompanied by a statement showing the length of each division, branch and separate line, with the names of its termini; and showing also what lines or parts of lines are worked by the block system, specifying the kind, whether manual, controlled manual or automatic.

Sec. 8. That every carrier to which an order requiring the adoption or use of the block system shall be issued, under this act, shall within three months after the receipt of such order file with the Commission a plan or sketch of the line or lines affected by such order, with a statement of the means and methods intended to be used in carrying out the order. Such statement of means and methods shall include the rules under which the carrier intends to order and regulate the movement of all trains, on such line, under the block system; and said rules, when approved by the Commission, shall be the lawful regulations for the movement of trains on the line or lines affected by such order; and it shall be unlawful to move any car or engine on such line except in accordance with such rules.

An order may be issued specifying "one-fourth" or "one-half" or "three-fourths" of a line, in accordance with this act; and in such case it shall be the duty of the railroad company to decide what part or parts of its line or lines shall be taken to make up such fraction, and to embody such decision in its plan and statement to be sent to the Commission. In default of such decision and statement it shall be the duty of the Commission to decide what line or lines or parts thereof shall be subject to its order; and an order specifying lines approximating, in length, the fractions named in this act shall be lawful. An order may allow exceptions and modifications; and may be revised and reissued.

Sec. 9. That whenever and wherever there shall exist, on a railroad line where the block system is in use, or is to be adopted in accordance with this act, any switch, drawbridge, railroad crossing, or street railroad crossing, which is not provided with an adequate interlocked signal, suitably fixed and maintained and regularly attended, the Commission may require the carrier to submit for approval a rule or code of rules limiting and regulating the speed of all trains passing or approaching such drawbridge, switch or crossing; and it shall be unlawful, after a date fixed by the Commission, to move a train, car or engine on or across such drawbridge, switch or crossing, except in conformity to such rule or rules, approved by the Commission.

Sec. 10. For the purposes of this act a passenger line shall be deemed to be any railroad or part of a railroad on which one or more trains for conveyance of passengers are regularly run in each direction each week day; *Provided*, that this act shall not apply to any railroad, or section of a railroad, on which, by a suitable regulation, approved by the Commission, only one engine under steam, or one electric engine or motor car, or two or more such engines or motor cars coupled together, are or will be permitted to be at any given time; and provided further that for the purposes of this act an engine or a car, running by itself, shall be deemed a train.

Sec. 11. That the Commission, before issuing any order under either of the first five sections of this act, shall give full and due hearing to all persons and carriers interested.

Sec. 12. That the Commission be and hereby is empowered and directed to enforce this act; and said Commission, by suitable agents and inspectors, shall keep itself informed concerning the action of the carriers in the matters to which the act applies.

Any circuit court of the United States shall have jurisdiction to issue a writ or writs of mandamus against any carrier subject to this act, commanding obedience by such carrier to any lawful order made by the Commission under this act; and the Commission may apply to any such court for such writ against any carrier which shall wilfully neglect or refuse to obey any such order. It shall be the duty of the district attorney, under the direction of the Attorney-General of the United States, to prosecute all necessary proceedings for the enforcement of this act, and the cost and expenses of such prosecutions shall be paid out of the appropriation for the courts of the United States.

Sec. 13. That every carrier subject to this act shall file with the Commission, twice each year, in January and in July, beginning in July, 1904, a report, on a form to be prescribed by the Commission, setting forth the number of miles of its railroad on which the block system was in use on the last days of December and June, respectively, preceding the filing of the report; specifying the kind of block system in use on each division or section. The first report made by any carrier under this section shall be accompanied by a copy of the regulations which are followed in the management of the block system; and each subsequent report shall be accompanied by a statement of changes (if any) which have been made in such regulations since the last preceding report was made.

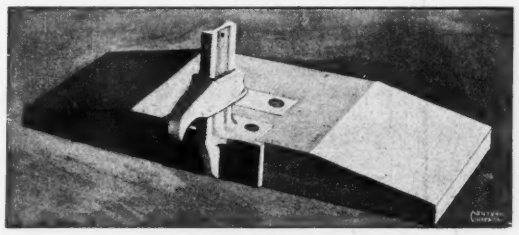
Sec. 14. That for the purposes of this act the term "block system" shall be taken to mean the methods and rules by means of which the movement of railroad trains (cars or engines) may be regulated in such manner that an interval of space, of absolute length, may at all times be maintained between the rear end of a train and the forward end of the train next following. The term shall be taken to include automatic block-signaling, so-called; but no order shall specify the kind of block system, or make or cause any discrimination between automatic, so-called, and non-automatic.

Note.—Section 14 above may be amplified as follows: The term "block system" is used to designate the method whereby, by the use of the telegraph, telephone, or electric bells, or by automatic apparatus, each train is prevented from leaving a certain point until the last preceding train has passed beyond a certain point farther on. On single-track railroads the system is also a preventive of collisions between trains moving in opposite directions toward each other, as the men or apparatus at each end of each block section, whose duty it is to protect following trains, are equally available for the protection of opposing trains.

The Handy Journal Box Jack Block.

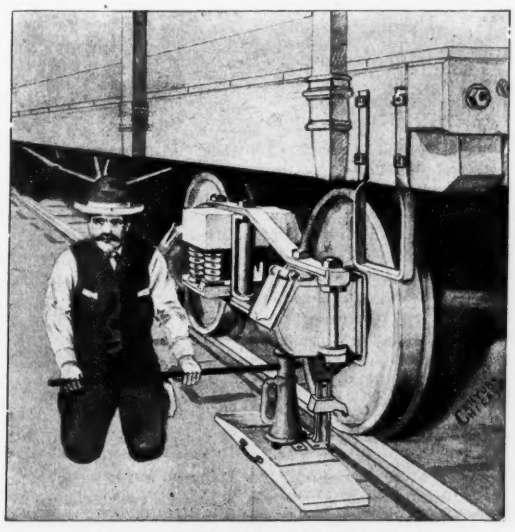
The removal of journal bearings and wedges and the insertion of new ones is at times difficult because the wheels lift when the load is lifted by the jack under the journal box, the result being that the bearing and wedge do not become free. The usual procedure is to use from two to four men to assist the man with the jack blocks —bars and levers being required to hold the wheel down.

The device here illustrated is designed to reduce the



The "Handy" Journal Box Jack Block.

time and labor in changing bearings both on the road and in yards. It is claimed that one man with any good journal box jack and with this jack block can change bearings in from five to 10 minutes. The device consists of a base or block of oak 9 in. x 2½ in. x 26 in., which rests on the ties or ballast. The journal box jack rests on this block. On the inner edge of the block is a malleable casting having top and bottom flanges for securing it to the block by bolts and rivets. On this casting there is



Manner of Using "Handy" Jack Block.

a post having teeth on the edge next to the wheel. Moving loosely on this post is a malleable iron hook having teeth for engaging with the teeth on the post. The projecting hook or arm engages the rim of the wheel. The teeth prevent the hook from slipping upwards when the strain is applied. A handle is provided for carrying the device.

The jack block is sold by the Handy Car Equipment Company, Old Colony Building, Chicago, Ill.

TECHNICAL.

Manufacturing and Business.

The Corinth Engine & Boiler Works has recently been organized, with a capital of $50,000, with headquarters at Corinth, Miss., and is now in the market for machinery.

The Kenton Iron & Steel Company of Covington, Ky., will build works at Washington, Ind., in which to make rod iron and bridges. It needs some shears and other machinery.

The Southern Mill, Mine & Railway Supply Company of Davidson County, Tenn., has been incorporated with a capital stock of $25,000, by F. J. Fuller, C. S. Brown and others.

The machine tool business of the Pittsburgh Shear, Knife & Machine Company, Pittsburg, Pa., has been sold to the Erie Foundry Company, Erie, Pa., which intends to increase and extend the newly acquired line.

The Wabash has canceled its contract with the Fuller Co. for the building of the Pittsburg terminal and will complete the work itself. This action is due to the fact that the Fuller Co. has been tied up by strikes.

The Philip Carey Manufacturing Company, Hamilton, Ohio, maker of magnesia flexible cement roofing and 85 per cent. magnesia pipe coverings, has got out a handsome calendar for 1904 which shows a list of branch offices in 14 large cities.

The West Virginia Bridge & Construction Company of Wheeling, W. Va., maker of bridges, etc., has the contracts for building the Fulton bridge over Loup River, in Nebraska, for $24,500, and the Genoa bridge over the same river for $25,800.

The Light Inspection Car Co., of Hagerstown, Ind., has recently sent one of its four-passenger gasoline motor inspection cars to the Belfast & Northern Counties Railway, Ireland, for the use of its Chief Engineer. This company also has an order for a motor car of the same type for the Government Railroads of South Australia.

The Southern Contracting Company of Corpus Christi, Texas, has been incorporated with a capital stock of $225,000, to build railroads and bridges. W. R. Lewis, Matagorda County; S. A. Robertson, of Orange, and others are incorporators.

The new steel castings plant of the Gould Coupler Company at Depew, N. Y., was put in use on November 30. The buildings are of brick and steel and cover several acres. The new plant will add 600 men to the working forces of the company at Depew.

The Bullock Electric Mfg. Co., of Cincinnati, Ohio, will at once rebuild its shop No. 2, recently destroyed by fire, and put in new machine tools. The company is having plans made for a new building to be about 100 ft. x 175 ft., about double the size of the former shop. The contracts have not yet been given out.

James C. McKee, of Cleveland, Ohio, who controls many of the patents used in the manufacture of steel cars, is in Minneapolis looking into the proposition of establishing shops in which to make cars. It is understood that the Commercial Club has agreed to furnish a site of 30 acres for the plant. The buildings will cost in the neighborhood of $375,000. Machinery will cost an additional $250,000.

According to the Milwaukee papers the men in the American Bridge Company's Works in that city have suffered a reduction of wages. Piece workers are reduced 10 per cent. Salaries below $4,000 a year are reduced 20 per cent., and those between $4,000 and $10,000, 25 per cent. This affects several hundred men. Reductions have also been made at the Philadelphia works of the company, and at those in Trenton.

The Loomis-Pettibone Gas Machinery Company has been merged with the Holthoff Machinery Company of Milwaukee, Wis., under the new corporate name of Power & Mining Machinery Company, 52-54 William street, New York. Extensive improvements and additions are being made to the Milwaukee plant. The company makes and sells the American Crossley gas engines, Loomis-Pettibone gas apparatus and Holthoff mining machinery.

The following appointments are announced by the Empire Bridge Company, to take effect Jan. 1, 1904: James H. Edwards, Assistant Chief Engineer, in charge of building construction, 7 West 22nd street, New York.; C. G. Emil Larsson, Assistant Chief Engineer, in charge of bridge construction, 100 Broadway, New York; J. E. Wadsworth, Resident Engineer, 7 West 22nd street, New York, and O. E. Hovey, Engineer in Charge of Bridge Design, 100 Broadway, New York.

It is reported that Fay & Bowen, composed of Walter L. Fay and Ernest S. Bowen, makers of gasoline motors, etc., intend to move their works from Auburn to Geneva, N. Y., to secure enlarged facilities. It is proposed to organize a new company, with a capital stock of $40,000, half of which has already been subscribed, and to build its works on a site where shipping facilities can be had on Lake Erie, the Erie canal, the New York Central and the Lehigh Valley railroads.

The Hudson River Electric Power Company of Queensbury, Warren County, N. Y., has been incorporated with a capital of $1,000,000, to develop the power of the falls of the upper Hudson, and to distribute electric power to Utica and Syracuse on the west, and Hudson on the south. The charter authorizes the company to build dams in the Hudson River and other streams in Saratoga, Washington and Warren counties. E. J. West, B. E. Morrow and L. W. Guernsey of Glens Falls, and others are directors.

The following appointments are announced by the American Bridge Company: James H. Edwards, Assistant Chief Engineer, in charge of building construction, Ambridge, Pa.; C. G. Emil Larsson, Assistant Chief Engineer, in charge of bridge construction, Ambridge, Pa.; Richard Khuen, Resident Engineer, Ambridge, Pa., and Albert Reichmann, Resident Engineer, Monadnock Block, Chicago, Ill. The offices of Division Engineer at Pencoyd, Pa., and Pittsburg, Pa., are abolished. The estimating and designing forces heretofore maintained at Pencoyd, Pa., and Pittsburg, Pa., have been transferred to Ambridge, Pa.

Iron and Steel.

After an extended idleness the works of the Pennsylvania Car Wheel Co., Allegheny, Pa., recently resumed work.

At the East Works of the American Iron & Steel Co., Lebanon, Pa., the 18-in. mill has resumed work after a shutdown of two weeks.

It is reported that the Tennessee Coal & Iron Company has advanced the price of pig iron from $9.50 to $10 a ton. The advance is regarded as indicating a better tendency in the Southern pig iron market.

The Carnegie Steel Company will soon start its new armor plate plant, which cost about $2,000,000, and which will double the capacity of that department at Homestead. The largest forging press and heading furnaces in the world have been built for it. A new machine shop has also been built.

The Eclipse Rolling Mill & Mfg. Co. of Birmingham, Ala., recently incorporated, is preparing to build a rolling mill, on which work will soon be commenced. The buildings have been contracted for. The company is in the market for several large shears, helve hammers, bolt headers, spike machines, blowers and a large amount of additional machinery. John J. Wirth is Treasurer of the company.

Electric Equipment for the New York Central.

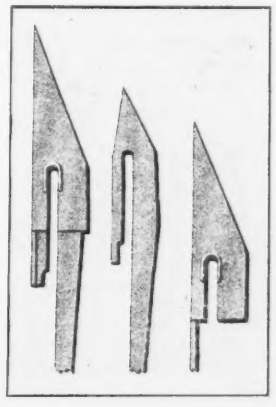
The General Electric Co. has obtained a contract to supply control equipment for 340 motor cars and 160 trail cars for the New York Central. The Sprague-General Electric control system will be used. The trains will be made up of two motor cars, one at each end, and a trail car in between them will weigh loaded approximately 100 tons. Two G. E. 66 motors, mounted on one truck, will be furnished for each motor car.

Turn-table Foundations.

In the modern industrial railroad equipment turn-tables for out-door work are frequently set upon too shallow a foundation, the result being that they are thrown out of line by frost. In the new plant of the B. F. Sturtevant Company at Hyde Park, Mass., where special turn-tables of their own make are used, each turn-table rests on the top of a circular brick well with 8 in. walls extending to a depth of 4 ft.—or below the frost line. These walls are set upon hard-pan and the center filled with loose stones, thus providing perfect drainage. The first winter's experience has shown this arrangement to be satisfactory.

The Pryor Dipper Teeth.

The illustration shows the Pryor two part cast steel tooth which is particularly adapted to use on shovels, dredges, dippers and excavators. The tooth consists of two parts, namely, the shank or prong and the removable point. The shank is bolted to the dipper in the same manner



as the old stylе tooth and the point is placed over the shank and is bolted to it. As there is no wear on the shank, it will last indefinitely, while the points when dull or worn out can be removed and resharpened or replaced. It is claimed that the points wear much longer than solid teeth of the same size and are also cheaper. The teeth are sold by the Pryor Patent Excavator Tooth Company, Houghton, Mich.

Power & Mining Machinery Co.

The Loomis-Pettibone Gas Machinery Company has been merged with the Holthoff Machinery Co., of Milwaukee, Wis., under the new corporate name of Power & Mining Machinery Company, which is making extensive improvements and additions to the Milwaukee plant to meet the increasing demand for the American Crossley gas engines, Loomis-Pettibone gas apparatus, and Holthoff mining machinery. The Loomis-Pettibone gas producers successfully generate a fixed gas for power and metallurgical work from either anthracite or bituminous coals, coke or wood. The Crossley gas engine, of which there are over 50,000 in operation, is made by this company. It is guaranteed to produce power with a consumption of one pound of good bituminous coal per brake horse power hour, or with two and one-half pounds of wood.

The Lackawanna & Wyoming Valley.

A controlling interest in the Lackawanna & Wyoming Valley Rapid Transit Company, the double track electric railroad recently built between Scranton and Wilkesbarre, Pa., has been bought by the Westinghouse Electric & Mfg. Co., which has taken about $6,000,000 worth of the stock and bonds. The Westinghouse Company intends to equip the road with some of its latest electrical devices; and, according to the reports, the testing of these devices is the principal object in the purchase of the road, which will subsequently be sold to some railroad company. The securities taken by the Westinghouse Company are $4,000,000 of 5 per cent. first lien consolidated mortgage bonds, and $2,000,000 of stock. It is said the new owners contemplate extending the road southward from Wilkesbarre to Nanticoke, and northward from Scranton to Carbondale.

Laconia Car Company Works Extensions.

On account of an increase in business the Laconia Car Company at Laconia, N. H., is making extensive additions to its plant, which are expected to be completed by Jan. 15. The company is putting in one large compound engine and two generators of 300 h.p., operating independent motors in each of the shops. It has also largely increased the capacities of the foundries, having put in a number of new ovens in both the malleable foundry and also in the grey iron foundry, as well as several additions to the wheel foundry. The company has equipped the entire plant with air hoists and is using a great many air drills, all of which are supplied with air by two large

air compressors. The company has one of the finest car plants of its size in the country. Its 1903 business was the largest in its history, both for freight and passenger cars. The capacity of the works is two passenger cars and six freight cars a day, for which all castings, both grey and malleable iron as well as brass, are made on the premises, as are also all wheels and trucks.

THE SCRAP HEAP.

Notes.

Newspapers west of the Mississippi River are very generally announcing that the railroads in that territory have decided to discontinue the practice of giving stock drovers free return tickets.

The International Committee of the Young Men's Christian Association has issued an illustrated pamphlet showing the progress in the railroad department from Jan. 1, 1903, to Jan. 1, 1904. The current expenses during the past year for this department were $617,485, of which sum 40 per cent. was given by railroad companies and 60 per cent. by railroad men. The membership shows an increase from 50,172 to 62,348 and 18 new associations have been established. The total valuation of the buildings now owned is $1,821,550, an increase of $296,050.

The Supreme Court of Missouri has sustained the Circuit Court of St. Louis in enjoining the ticket brokers of that city against dealing in World's Fair excursion tickets. After the decision at St. Louis the scalpers secured a writ of prohibition virtually suspending the order of the court; but this writ has now been abolished or nullified by the Supreme Court, and the injunction originally obtained goes into effect, restraining 40 or 50 persons or firms, who were named in the suits, from dealing in signature tickets sold at reduced rates and marked non-transferable.

The grain dealers of Omaha have been engaged for several months in trying to make that city a great grain market; or, perhaps we should say, a greater grain market than it has heretofore been; but the Chicago Great Western, with its new line from the East into that city, has kept the hopes of the dealers alternately rising and falling by the doubtful tone of some of its promises to reduce rates to the East. With the constant succession of doubts, the building up of the market has seemed, a good deal of the time, to be very much like trying to make a lake in a sand bank; and now the Chicago & North Western has "almost paralyzed" the new grain market, before its birth, by making rates under which it will carry grain through from Nebraska to Chicago so cheaply that the cars will have no disposition to stop at Omaha. The North Western makes the unfeeling explanation that if it does not make the through rate less than the sum of the locals to and from Omaha, the grain will go East from that city by the line of some other company.

It is said that the Erie Railroad will hereafter exchange passes with railroads in the West, but will adhere to the anti-exchange agreement as regards its relations to other lines in trunk line territory. The Erie is the only single railroad company which is operated by one management through from New York to Chicago, and thus is in a position different from that of its trunk line competitors. The Grand Trunk is understood to have taken a position similar to that of the Erie. Exchange passes issued by a railroad a thousand miles long appear to be extremely popular, strange as that may seem. If we may believe the statement of a western newspaper the Erie has been "favored" with 90 per cent. of the private cars going from Chicago and other western points to New York. On a railroad not issuing passes for the private car of an officer of another railroad the bill for such a car is usually 18 fares, or, say, $360 between New York and Chicago. This may partly explain the 90 per cent., and would seem to indicate that the Erie's liberal policy is not a new thing.

A Long Felt Want—

Or a pressing demand—has been met. According to an exchange, "The Northern Pacific has introduced a novel feature on its North Coast Limited by which passengers can have their clothing pressed while they sleep."

Anthracite Coal Production.

The output of anthracite coal from the Pennsylvania mines for the 11 months ending with November was 55,103,082 tons, and the *Philadelphia Record* estimates that the total production for the year will be 59 million tons, which is 5½ millions greater than in 1901 and nearly twice the product of 1902, the year the strike occurred. The stocks on hand at the present time are not large.

The Burlington Relief Department.

A new basis has been adopted for the computation of insurance in the relief department of the railroads in the Chicago, Burlington & Quincy system, and all death benefits are to be increased 20 per cent. without increasing the fees. Members may now take a larger amount of life insurance than formerly. In the highest class the limit is now $9,000 instead of $5,000, as before. Under the new rules an employee who is sick more than a year will continue to receive benefits at half rates for another whole year, if his sickness continues so long.

Disastrous Butting Collision at East Paris, Mich.

On Saturday evening, December 26, a butting collision of passenger trains on the Pere Marquette Railroad a short distance west of East Paris, Mich. (near Grand Rapids), resulted in the wreck of both engines and the first two cars of each train and the death of five trainmen and 17 passengers, and injury to 29 persons. A snow storm prevailed at the time, and it is said that the engineman and fireman of the eastbound train had not even seen the other train when the collision occurred. The boiler of the engine of this train was knocked into a perpendicular position, being completely detached from the frame. The collision was due to the failure of the westbound train, No. 5, to stop for orders at McCord's, and it is said that the light on the train order signal at that station had been blown out by the high wind that was raging. The operator asserts that the light had been properly burning two minutes before the train arrived, and on the strength of this statement the newspapers proclaim in their headlines that the accident was not due to human carelessness or neglect, but to the storm. The man who was in charge at McCord's is an experienced operator. An officer of the road says that this is the first time that a passenger has been killed in a train of that company.

Sixty Passengers Killed at Laurel Run, Pa.

On the night of December 23, a little before 8 o'clock, eastbound passenger train No. 12 of the Baltimore & Ohio was derailed at Laurel Run, Pa., by running over some timbers which had fallen on the track from a freight car, passing in the opposite direction on the adjacent track; and the engine and first three or four cars were wrecked. The baggage car and smoking car were piled up on the locomotive, and steam from some broken part of the boiler quickly scalded to death most of the occupants of these two cars. Many victims who were scalded escaped with their lives but died within a day or two at the hospital. The latest accounts indicate 65 or more persons killed or fatally injured, and about 30 others injured. The train was running very fast and every person on it suffered a severe shock. The engineman, fireman and news agent were killed and two or more of the trainmen were injured. All of the rest of the injured were passengers, most of them riding in the smoking car, and many of them foreigners and negroes. The timber, or sleeper, which lodged on the track, had fallen from a gondola car as it passed around a curve in the line. This car was in a freight train which had passed westward about 15 minutes before No. 12 reached the point. An officer of the road is quoted as saying that the car was loaded at Friendship, Md. There are two places of that name on the map, one on the Chesapeake Beach railroad and one on the Philadelphia, Baltimore & Washington.

Baggage Going to Canada.

It is announced that beginning January 1 the Canadian Government will resume the former practice of permitting the baggage of passengers going from the United States to Canada to be bonded to interior ports; and the inspectors will board through trains on this side of the line some distance before reaching the border, thus making it possible to finish the inspection before the train enters Canada. Since the first of last year, all baggage except to the large places (Toronto, Montreal, Quebec, etc.), has had to be examined at the frontier. This arrangement has been unsatisfactory, and passengers will now be permitted to have their checked baggage examined on arrival at destination. On the first of May last, the Canadian Government decided to prohibit the bonding of baggage to points in Canada, and to insist that it be examined at the frontier point, but, as before stated, this did not work well, and now baggage may be bonded to the many interior ports of Canada and examined at destination. Baggage that is checked from a point in the United States, to a point in the United States, through Canada, has always been exempt from examination, being forwarded in bond under manifest, and will continue to be so handled. The passenger is not materially affected by the new regulation, except that he will find it more convenient to have his checked baggage examined at destination instead of having to go into the baggage car at the frontier point. There will now be little or no delay to trains at the frontier point.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

The Railway Signal Association.

The Secretary of the Railway Signal Association announces that on Tuesday, the 12th, the regular day for the January meeting of the Association, meetings will be held both in New York and in Chicago; in New York at the Grand Union Hotel, 42nd street and Fourth avenue, and in Chicago at the Great Northern Hotel. Further announcement will be made next week.

PERSONAL.

—Mr. William Fleming, Secretary of the Trunk Line Association, has resigned his office, to take effect January 1. He has been connected with the Trunk Line for many years.

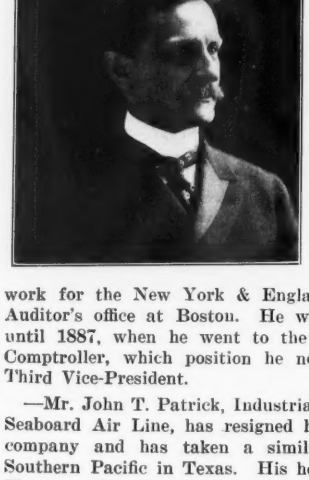
—Mr. John R. Hastings, who for several years was General Superintendent of the Chicago, Burlington & Northern, died at his home in St. Paul, Minn., on Thursday, Dec. 16.

—Mr. Henry U. Frankel, President of the Moran Flexible Joint Company of Louisville, Ky., and well known by railroad mechanical officers throughout the country, died Dec. 8, at the age of 53.

—Mayor George B. McClellan of New York City has announced the appointment of George E. Best as Bridge Commissioner, and John T. Oakley, as Commissioner of Water Supply, Gas and Electricity.

—Mr. Royal C. Vilas, President of the Pyle-National Electric Headlight Company, and for many years on the Erie as General Freight Agent and Freight Traffic Manager, died at his home in Chicago, Tuesday, December 29, of pneumonia. Mr. Vilas was 61 years old and was a native of Ogdensburg, N. Y. His first railroad work was in 1862, when he began as a clerk in the Freight Clearing House at Cleveland. For three years from 1869 he was in the general office of the Great Western Despatch, and in a few years became the General Manager of that line.

—Mr. Hiram M. Kochersperger, who has been chosen Third Vice-President of the New York, New Haven & Hartford to succeed Mr. Barnett, was born Dec. 27, 1856, at Philadelphia. He was educated in that city and began work in 1873 on the Philadelphia & Reading at Port Richmond, Philadelphia, where he remained until 1878. He then went west and entered the service of the Atchison, Topeka & Santa Fe at Topeka, Kansas, as a clerk. In 1881 he returned east and went to work for the New York & England as a clerk in the Auditor's office at Boston. He was with this company until 1887, when he went to the New Haven road as Comptroller, which position he now resigns to become Third Vice-President.



—Mr. John T. Patrick, Industrial Commissioner of the Seaboard Air Line, has resigned his position with that company and has taken a similar position with the Southern Pacific in Texas. His headquarters will be at Houston. Mr. Patrick's work on the Seaboard Air Line has been described in the *Railroad Gazette*. A reporter of the New Orleans *Item* who saw Mr. Patrick on his way to Texas quotes him as saying that he is not going to accept any compensation from the company until he shows a satisfactory measure of work accomplished. The company will bear the expenses of the necessary clerical force, but Mr. Patrick's personal expenses will be defrayed by himself.

—Mr. H. E. Hale, who succeeds Mr. Spielmann as Superintendent of the Baltimore & Ohio at Butler, Pa., is a native of Minnesota and is 29 years old. He is a graduate of Lehigh University. During the summers of 1891 and 1892 he worked in the construction department as rodman on the Pennsylvania Railroad at Phillipsburg, and the next two were spent in Jersey City as rodman in the Maintenance of Way department. In 1896 he went to West Philadelphia in a similar capacity, and five years later became Supervisor of Signals at Camden. His service on the Baltimore & Ohio dates from March, 1902, when he began as Assistant Engineer at Baltimore. In a few months he was made Division Engineer at Philadelphia, from which position he is now promoted to the Superintendency at Butler.

—Mr. Edward Averitt Williams, the new Assistant General Manager of the Erie, who comes from the Canadian Pacific, was born at Wiscasset, Me., 55 years ago. His first office in the railroad service was that of roundhouse foreman of the Chicago, Milwaukee & St. Paul at Prairie du Chien. This was in 1877. He had served in the mechanical department 12 years before this, having begun as a machinist apprentice in 1865 on the old Milwaukee & Prairie du Chien. In 1880 he was transferred to Wells, Minn., as General Foreman of the Southern Minnesota Division, and in 1886 was made Assistant General Master Mechanic, with office at Milwaukee. From 1890 to 1893 he was on the Minneapolis, St. Paul & Sault Ste. Marie as Master Mechanic in charge of the locomotive and car department, and in September, 1893, he was appointed Mechanical Superintendent. From this position he was in January, 1901, promoted to the position he now leaves, that of Superintendent of Rolling Stock of the Canadian Pacific.

—Mr. A. Robertson, who has been appointed General Manager of the Terminal Railroad Association of St. Louis, began his railroad service on the Fitchburg, and no longer ago than 1885 was a brakeman on the trains of that company. In 1897 he went to the Wabash, taking a position as yardmaster. He was promoted successively to the positions of Trainmaster at Decatur and Superintendent of the Middle Division. A few months ago, when

the Western Maryland and the West Virginia Central & Pittsburg came under the control of the Wabash, he was made Manager of those lines. His call, at this time, from Baltimore to St. Louis, is in furtherance of the plans of the Terminal Railroad Association to strengthen its organization in preparation for the increased business expected next year on account of the Louisiana Purchase Exposition.

—Gen. Alfred Perkins Rockwell, who died from heart failure Dec. 24, retired from business about 17 years ago, after a long and interesting career of varied activities. Gen. Rockwell was born at Norwich, Conn., in 1834, and graduated from Yale in 1855, subsequently taking post-graduate courses in geology and mining engineering at London and Freiburg, Saxony. He pulled an oar in the first Yale-Harvard regatta, in 1852. Serving three years in the army as captain of the First Connecticut Light Battery, and Colonel of the Sixth Conn. Vol. Infantry, he was breveted Brig.-Gen. U. S. V. in 1865 for gallant and distinguished services in the field during the campaign of 1864. Gen. Rockwell has at different times been Professor of Mining at the Sheffield Scientific School and at the Massachusetts Institute of Technology; Chairman of the Boston Fire Commissioners, and Treasurer of the Great Falls Mfg. Co. From 1876-9 he was President of the Eastern Railroad (Massachusetts), now part of the Boston & Maine system, which at that time operated 282 miles of road. Gen. Rockwell was widely known as a mining engineer and a soldier, and represented Yale at the Millenary celebration of King Alfred the Great, at Winchester, England, in 1901.

—Mr. C. A. Smith, the veteran Master Car Builder of the Union Tank Line, died at his home in East Orange, N. J., on December 28 after an illness of two weeks. Calvin Augustus Smith was born at Newfield, Maine, Aug. 16, 1822, and spent the first years of his life on the farm of his father, who was a strict Puritan. When he was 18 years old he began work in the car shops at Lawrence, Mass., as an expert mechanic, although he had had no previous training or experience. He went to the Erie when that road was first built and remained there until 1878, rising to the position of Superintendent of Car Shops of the Eastern Division, which he held from 1861 to 1876. While in charge of the Erie shops he built the first four sleeping cars that were run east of Chicago. They were built by the Erie for the Pullman Company; and Mr. Smith had entire charge of the selection of material and their construction. On their completion he was presented by Messrs. Jay Gould and James Fisk, then in control of the Erie, with a handsome gold watch, suitably engraved, which he carried to the time of his death. In 1878 he went to the Union Tank Line as Superintendent of Car Construction and Repairs, which position he held until 1902, when he was made Consulting Engineer of the company. On April 1, 1903, he was honorably retired on a pension, and from that time until his death, enjoyed a well earned rest. Mr. Smith was one of the oldest members of the Master Car Builders' Association, having become a member in 1870. In 1900 he was made a life member, in appreciation of his work in that organization and in the car building field. From 1874 to 1882 he was Secretary of the Association, and during all the years of his active membership took an important part in the discussions and committee work. He was also a charter member of the New York Railroad Club, and was one of the members of the original committee appointed by the M. C. B. Association to prepare the Car Builders' Dictionary. Mr. Smith belonged to the old school of car builders and though always reserved and conservative in his opinions he was tireless in his efforts to improve that branch of railroading with which he had the most to do. Many kindly and well deserved tokens of affection presented to him at different times by the organizations of which he was a member testify to the high esteem and lasting good will with which he was held by his friends and fellow workers. His wife, who was Margaret Morse Frost, and two sons, survive him.

ELECTIONS AND APPOINTMENTS.

Atlanta & West Point.—A. R. Smith has been appointed General Freight Agent.

W. M. Cox, hitherto Acting Superintendent at Montgomery, Ala., has been appointed Superintendent.

Baltimore & Ohio.—President L. F. Loree has retired from this company to become President of the Rock Island Company of N. J., and O. G. Murray, First Vice-President, has been elected to succeed Mr. Loree as President of the B. & O. (See Rock Island Company of New Jersey.)

F. C. Batchelder, Division Superintendent at Newark, Ohio, has resigned. (See Erie.)

Canadian Pacific.—D. McNicoll, Second Vice-President and General Manager, has been elected Vice-President. William Whyte, of Winnipeg, hitherto Assistant to the President, becomes Second Vice-President.

Chicago, Rock Island & Pacific.—At a meeting held on Tuesday of this week W. B. Leeds was re-elected President; D. G. Reid, Chairman of the Board; Charles H. Warren, First Vice-President; Robert Mather, Second Vice-President; B. L. Winchell, Third Vice-President; John F. Stevens, Fourth Vice-President, and George H. Crosby, Secretary and Treasurer. The following appointments were made by the Board: George T. Boggs, Assistant Secretary and Assistant Treasurer in New York City; C. F. Jilson, Assistant Secretary and Assistant Treasurer in Chicago. It is understood that Mr. Loree will soon be elected President of the railroad company, to succeed Mr. Leeds. (See Rock Island Company.)

Chesapeake & Ohio.—L. J. Houston has been appointed Division Engineer of the Kentucky Division, with headquarters at Ashland, Ky., succeeding E. M. Hoadly, resigned.

Dansville & Mount Morris.—The offices of General Manager and Superintendent have been abolished; and William Humphrey has been appointed General Superintendent, with headquarters at Dansville, N. Y.

Erie.—E. W. Batchelder, formerly Superintendent of the Newark Division of the Baltimore & Ohio at Newark, Ohio, has been appointed Superintendent of the Meadville Division of the Erie, with headquarters at Meadville, Pa.

Louisville & Atlantic.—H. R. Smith has been appointed General Freight and Passenger Agent, with headquarters at Versailles, Ky., succeeding C. M. Browning, Traffic Manager, resigned.

New York, New Haven & Hartford.—On Friday of this week the following assignment of duties took effect: The First Vice-President will have general supervision of the traffic department of the whole system and of the transportation department of the rail lines. The Second Vice-President will have charge of the construction and electrical department, but not including operation, the maintenance of way and structures, including all buildings and signals, but not including the operation of signals. In addition he will represent the company in Massachusetts and Rhode Island in all matters in the absence of the President. The Third Vice-President will have general charge of accounting, treasury, pay and purchasing departments, the operations of which are subject to his approval. He will have general supervision of all financial and accounting matters of the corporations in which the company is financially interested. He will prepare and issue for the information of the officials all statistics of the company's business. All statistics other than those authorized and kept by his authority are prohibited. T. H. Fennell, hitherto Superintendent of the Highland Division, has been appointed Superintendent of the Hartford Division, with headquarters at Hartford, Conn., succeeding C. S. Davidson, who has been retired on account of his advanced age.

J. A. Warner, hitherto Agent of Freight Terminals at Boston, has been appointed Superintendent, with headquarters at Hartford, Conn., succeeding Mr. Fennell. C. M. Conklin succeeds Mr. Warner.

Pocahontas Coal & Coke.—M. J. Caples has been appointed General Manager, with office at Roanoke, Va. O. Lynn Bottomley has been appointed Treasurer, succeeding Mr. Caples, with office at Roanoke, Va. Mr. Bottomley will also act as Secretary. E. H. Alden becomes Assistant Secretary, with office at Philadelphia. The office of Superintendent has been abolished.

Rock Island Company of New Jersey.—At a meeting held December 29, L. F. Loree, President of the Baltimore & Ohio, was elected President, succeeding W. B. Leeds, who becomes Chairman of the Board of Directors.

Terminal R. R. Association of St. Louis.—A. Robertson, hitherto Manager of the Western Maryland, has been appointed General Manager of the T. R. R. A. of St. L. At present Mr. McChesney holds the offices of both President and General Manager.

Toledo, St. Louis & Western.—T. P. Shonts, formerly President and General Manager of the Indiana, Illinois & Iowa, has been elected President and General Manager of the T., St. L. & W., with office at Toledo, Ohio, succeeding Benj. Norton, resigned.

Wabash.—On January 1 the Western Division, which has heretofore included all lines west of the Mississippi River, was divided into the St. Louis Division and the Western Division. J. S. Goodrich was appointed Superintendent of the St. Louis Division, and Richard Doyle was appointed Superintendent of the Western Division, both with office at Moberly, Mo.

H. G. Clark, Division Superintendent at Decatur, Ill., has resigned. (See Western Maryland.)

Western Maryland.—H. G. Clark, hitherto Division Superintendent of the Wabash at Decatur, Ill., has been appointed Manager of the W. M., with headquarters at Baltimore, Md., succeeding A. Robertson, resigned. (See Terminal R. R. Association of St. Louis.)

W. J. Bingley has been appointed Assistant Master of Machinery, with headquarters at Hanover, Pa., succeeding the late J. B. Snyder.

Yazoo & Mississippi Valley.—E. T. Horn has been appointed Superintendent of the Memphis Division, including Memphis Terminals, with headquarters at Memphis, Tenn., succeeding J. T. Paul, resigned. The position of Superintendent of Terminals at Memphis has been abolished.

LOCOMOTIVE BUILDING.

The Pere Marquette is reported to be asking bids on a number of locomotives.

The Delaware, Lackawanna & Western is in the market for 30 locomotives.

The St. Joseph & Grand Island is having six locomotives built at the Baldwin Works.

The Mexican Central is having six locomotives built at the Cooke Works of the American Locomotive Company.

The Delaware & Hudson's order for 29 locomotives is still undecided and it is thought that the contract will not be let until early in the spring.

The Chesapeake & Ohio has received the following equipment during 1903: Fifty consolidation (2-8-0) locomotives, three Atlantic (4-4-2) passenger locomotives, two Mountain type passenger locomotives, one switching locomotive and one Shay geared locomotive. The company also has outstanding contracts with the Baldwin Works for 25 locomotives, and with the American Locomotive Company for 25 locomotives.

CAR BUILDING.

The Manistee & Northeastern is reported in the market for a number of freight cars.

The Pere Marquette is reported to be asking bids on a large number of freight cars.

The Long Island has ordered 200 box cars from the South Baltimore Steel Car & Foundry Co.

The White Pass & Yukon will build two passenger coaches at its own shops at Skaguay during 1904.

The St. Louis, Brownsville & Mexico has ordered 200 box cars, five caboose cars, three baggage cars, three chair cars, five passenger coaches and three combination passenger, baggage and mail cars from the American Car & Foundry Company.

The Chesapeake & Ohio has received the following new equipment during the calendar year of 1903: Two parlor cars, eight coaches, three postal cars, 25 cabooses, one steam wrecker, 303 box cars of 80,000 lbs. capacity, 20 ballast cars of 60,000 lbs. capacity, 364 coke cars of 60,000 lbs. capacity, 450 flat cars of 80,000 lbs. capacity, 364 gondolas of 80,000 lbs. capacity, and 1,004 steel gondolas of 100,000 lbs. capacity. The compauy also has outstanding equipment contracts as follows: Three stock cars of 60,000 lbs. capacity, three box cars of 80,000 lbs. capacity, 25 gondolas of 80,000 lbs. capacity, two postal cars and 1,000 steel gondolas of 100,000 lbs. capacity.

BRIDGE BUILDING.

ALBANY, N. Y.—The Chamber of Commerce will be petitioned by the residents of Upper Rensselaer to join them in building a bridge over the Hudson River.

BOSTON, MASS.—Bids are wanted Jan. 16 by the Cambridge Bridge Commission for building the steel superstructure for the Cambridge bridge. Mayor Patrick A. Collins is a member of the Commission.

CENTERVILLE, MD.—Bids are wanted by Joseph M. Parvis, Queen Anne County, Jan. 12, for building a steel drawbridge 258 ft. long, with a draw of 110 ft., over Kent Island Narrows.

CRESTON, IOWA.—Bids are wanted Jan. 4 for furnishing the material and building all the bridges and doing bridge repair work in Union County during the year 1904. Geo. Brotherton is County Auditor.

DALLAS, TEXAS.—A resolution has been passed by the City Council authorizing the City Engineer to prepare plans for a bridge over Mill Creek at Park Avenue, and bids will probably be asked as soon as plans are completed.

DAYTON, OHIO.—The bids opened Dec. 22 for building the concrete steel bridge 710 ft. long over Miami River at Third street were: Adams Bros., Zanesville, Ohio, new bridge, $192,000; temporary bridge, $20,000; piles $1.00 per lineal foot, to be finished Jan. 1, 1905. M. Rabbitt & Sons Co., Toledo, new bridge, $313,728; temporary bridge, $26,272; piling 50 cents, to be completed Jan. 1, 1905. Ferro Concrete Construction Co., Cincinnati, new bridge, $199,500; temporary bridge $14,000; piling 65 cents, to be completed in nine months from date of contract. (Dec. 4, p. 877.)

DES MOINES, IOWA.—The Chicago, Rock Island & Pacific has commenced work on a new eight span steel girder, double track bridge over the Des Moines River on Vine street.

ELYRIA, OHIO.—The Baltimore & Ohio may build a bridge over Black River at this place.

FORT DODGE, IOWA.—The contract for the viaduct to be built at the point where the north extension of Fifteenth Street intersects the tracks of the Minneapolis & St. Louis Railroad has been awarded to N. M. Stark & Co. of Des Moines. The viaduct will be 530 ft. long, and including driveway and sidewalks 30 ft. in width, to cost $12,000 according to the contract, divided between Webster County, Fort Dodge City and the Minneapolis & St. Louis Railroad Company. The viaduct must be completed by May 1, 1904.

HEMPSTEAD, N. Y.—The Commissioners of Highways may build a steel bridge over East Creek, on Mill Road, to replace the present structure.

IOWA CITY, IOWA.—The Iowa City, Davenport & Muscatine Ry. Co. may build a steel bridge to cost $50,000.

LAWRENCE, KAN.—Bids are wanted Jan. 5, by Geo. A. Flory, clerk of the joint board of commissioners of Douglass and Leavenworth Counties, for building a bridge over the Kansas River at Eudora.

MIDLAND, ONT.—A report has been submitted to the county council recommending the construction of a steel bridge over the Sturgeon River on second concession of Oro.

NEWPORT, KY.—It is reported that the City Council and Board of Aldermen have given a franchise to the street railroad company to build a viaduct over Taylor Mill Bottoms from Sixth street to Bellevue.

RICHMOND, IND.—The City Council will petition the County Commissioners to build a bridge over the Whitewater in the lower part of the city. The Columbus, Greensburg & Richmond R. R. may be asked to contribute $15,000 towards the cost of the structure to make it a combined highway and railroad bridge.

SAGINAW, MICH.—The city will apply to the Board of Supervisors for permission to award the contract and build an iron bridge 30 ft. wide by 436 ft. long, over the Saginaw River at Center street.

TOLEDO, OHIO.—Bids are wanted Jan. 20, by the Board of County Commissioners, for building a 40-ft. bridge over Cedar Creek in Jerusalem township; also for abutments and approaches to a bridge in Keener road and at Stickney avenue; also for abutments and bridge on Secor avenue in Washington township. Bids are also asked Feb. 16 for $30,000 of bridge bonds. D. T. Davis, Jr., is County Auditor.

UNIONTOWN, PA.—The court has appointed viewers to report on the following proposed bridges: Over Dunbar Creek in Dunbar township; over George's Creek near Wharton Coke Works, and over Yorks Run in Nicholson township.

WESTFIELD, MASS.—The Selectmen are considering the building of a new bridge over the New York, New Haven & Hartford at Pochassic street, the present structure having been badly damaged by the corrosion of members in consequence of locomotives standing under it.

YANKTON, S. DAK.—Bids are wanted Jan. 5, for building all the bridges in Yankton County during the year 1904. C. L. Lawrence is County Auditor.

Other Structures.

ATLANTA, GA.—The Western & Atlantic, it is reported, may soon remove its shops from Atlanta to Ellen N., a point on its line between Atlanta and the Chattahoochee River.

BRISTOL, TENN.—Plans, it is reported, are ready for

new shops for the Virginia & Southwestern, to be located in the northwestern part of the city. The company will build box, freight, flat and passenger cars in its own shops when the new buildings are completed.

CALGARY, N. W. T.—The Canadian Pacific will shortly commence work on its new car shops at Calgary, to cost over $100,000.

CHANUTE, KAN.—The Santa Fe, it is reported, is preparing plans for a two-story machine and blacksmith shop 90 ft.x150 ft.

CHESTER, PA.—The Solid Steel Casting Company, maker of open hearth steel castings, is putting up a temporary shop to take the place of the one which was destroyed by a recent fire. In the Spring the company will put up a permanent structure.

CHICAGO, ILL.—It is reported that Frost & Granger are making plans for a new office building for the Chicago & North Western, to be located at Jackson boulevard and Franklin street, and to cost about $800,000.

CONNELLSVILLE, PA.—The Fisher Foundry & Machine Company of Pittsburg has plans ready to build works in Connellsville at a cost of about $400,000, in which to make steam engines.

FORT SMITH, ARK.—Reports are that the Missouri Pacific will build passenger and freight stations in this city early in 1904.

HAGERSTOWN, MD.—The Western Maryland, it is said, will build a brick station on which work will soon be commenced.

MARION, IND.—The Gemmer Engine Mfg. Co., Marion, is planning to build new shops to treble its present capacity of gas engines. One of the buildings will be 80 ft. x 160 ft., and the other about 80 ft. square. A number of machine tools will be required; a 5-ft. boring mill, a cylinder boring machine, 36-in. lathe, small lathes and drills.

NEW ROCHELLE, N. Y.—The New York, New Haven & Hartford is considering building a new passenger station.

OMAHA, NEB.—The Union Pacific may enlarge its shops in Omaha at an expense of about $250,000.

POTTSVILLE, PA.—The Eastern Steel Company of Pottsville, Pa., (William F. Donovan, of 45 Cedar street, New York, President), contemplates spending $1,000,000 for extending the plant. The company bought considerable machinery and steel plant equipment throughout the last year, but the plans for the extensions are not fully completed. It is said the work will include a large machine shop, blacksmith shop, foundry and rolling mill. These buildings are for expanding the bridge and structural business of the company.

ST. LOUIS, MO.—The Terminal Railroad Association, it is reported, will build three one-story engine houses on Poplar street, at a cost of about $15,000.

ST. PAUL, MINN.—The Chicago Great Western roundhouse at St. Paul was damaged by fire Dec. 22, to the extent of $24,000.

SCHENECTADY, N. Y.—Bids are wanted by the New York Central & Hudson River Railroad, Grand Central Station, New York, H. Fernstrom, Chief Engineer, January 4, for building a brick freight house, 50 ft.x572 ft., in Schenectady.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Railway Co., it is reported, has plans ready to build a new office building three stories high, 51 ft.x150 ft., in Cortland avenue, to cost about $20,000.

VICTORIA BEACH, N. B.—New wharves are to be built at the terminus of the Middleton & Victoria Beach Railway at Victoria Beach.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—According to a statement made by President Ripley, a large portion of the new $10,000,000 bond issue which was recently authorized, will be used to build the cut-off from Belin, N. Mex., to Texico, Tex. It is stated that work will be begun early in the spring. A portion of the bond issue will also be used to finish the Bradshaw Mountain branch, which is being built east of Prescott, Ariz. (Nov. 13, p. 822.)

BIRMINGHAM, MONTEREY & NEW ORLEANS.—An officer writes that this company is making preliminary surveys from Birmingham to Monterey, and to Meridian, Miss. Work of permanent location will be started in January, and it is expected that contracts for grading will be let about July 1. J. H. Smith is President; T. C. Purdy, Vice-President and General Manager, and J. E. White, Chief Engineer. The headquarters of the company are at Birmingham, Ala.

BOISE, NAMPA & OWYHEE.—An officer writes that an extension is now being built under the charter of the Idaho Northern, from Emmet to Garden Valley, 45 miles. J. M. Clark, Nampa, Idaho, is General Superintendent.

BUTTE COUNTY.—This line has been completed between Chico, Cal., and Coutolene, 23 miles. Grading is now in progress from Coutolene to Sterling City, seven miles. E. B. & A. L. Stone Company, Oakland, Cal., is the contractor; J. B. Robinson, Chico, Cal., is Chief Engineer. (June 12, p. 415.)

CALIFORNIA ROADS.—Press reports state that the California Door Company will soon begin work on a railroad from Diamond Springs, Cal., to Dogtown, 26 miles.

CLOVER RUN.—This road has been completed from Parsons, W. Va., to Walther, 6½ miles.

DOTHAN, HARTFORD & FLORIDA.—Grading has been begun on this proposed road from Dothan to St. Joseph, Fla., 117 miles. It is said that the entire line will be completed within one year. J. P. Pelham, Dothan, Ala., is interested.

FORT SMITH & NORTH ARKANSAS.—A charter has been granted this company in Arkansas to build a railroad from Fort Smith east to Webb City and thence north through Madison and Newton counties to Harrison, 130 miles. Geo. Sengel, Fort Smith, Ark., is President, and W. H. Robbins, Secretary.

GEORGIA TRACTION.—A charter has been granted this company to build an electric railroad from Carnesville, Ga., southwest through Madison and Clarke Counties to Athens, 40 miles. B. F. Aderhold, W. R. Little and others of Carnesville, Ga., are incorporators.

GREAT FALLS & OLD DOMINION.—Contract for grading and masonry work on the first seven miles of double track on this line has been let to W. J. Oliver, Knoxville, Tenn. The points to be connected are Rosslyn, Cherrydale, Chesterbrook and a point between Lewinsville and Langley, all in Virginia. (Dec. 11, p. 896.)

GREAT NORTHERN.—This company has completed its cut-off from Columbia Falls, Mont., to Whitefish, eight miles. It has also opened an extension from Souris, N. Dak., to West Hope, 16 miles.

GREAT NORTHERN OF CANADA.—Contract is reported let for building an extension of this line from Garneau Junction to Quebec, 70 miles. The estimated cost of the line is $1,200,000, and a subsidy of $3,200 per mile has already been granted. The contract calls for the completion of the line by Jan. 1, 1905.

GREEN BAY, OSHKOSH, MADISON & SOUTHWESTERN.—This company has been incorporated in Wisconsin to build a railroad from Madison northeast to Green Bay, 150 miles. This company is the same as the one reported in our issue of Nov. 13, p. 822, under the heading of Madison & Green Bay. W. K. Rideout, Leander Choate, R. T. Morgan, R. H. Hackett, all of Oshkosh, Wis., and H. S. McFall, Cleveland, Ohio, are directors.

JAMAICA & SOUTH SHORE (ELECTRIC).—Articles of incorporation have been filed by this company with the County Clerk of Queens. The company has been formed to take over the old New York & Rockaway R. R., which extends from Jamaica to Far Rockaway, and which was sold under foreclosure proceedings on May 27, 1903. The new line is to be operated by electric power between Jamaica and Far Rockaway, and it will connect at the latter point with the Ocean Electric Line, which extends from Far Rockaway to Rockaway Beach.

LIBERTY-WHITE.—Grading is reported completed on this line from Liberty, Miss., to McComb, 25 miles. Track laying will soon be begun, and it is stated that the line will be completed early in the spring. J. J. White, McComb, Miss., is President. (See Construction Supplement.)

LONE ROCK VALLEY.—This company has been organized in Wisconsin to build a railroad from Lone Rock north through Plain, White Mound, Lime Ridge and Ironton to La Valle, 30 miles. Connection will be made with the Chicago, Milwaukee & St. Paul at Lone Rock, and with the Chicago & North Western at La Valle. Geo. Jameson, Lone Rock, Wis., is President, and W. M. Rowe, Secretary.

MADISONVILLE TRACTION.—This company has amended its articles of incorporation to provide for building a railroad from Madisonville, Ky., through Earlington to Nortonsville, 12 miles. Joseph Huffaker is President.

MEMPHIS, INDIANOLA & GULFPORT.—This company has been organized in Mississippi to build a railroad from Memphis to Indianola, Miss., and thence to Jackson and to Gulfport. J. W. Buchanan, Memphis; R. Craig, Chicago; W. F. Heard and J. H. Baker, Indianola, Miss., are incorporators.

MEXICAN ROADS.—A concession has been granted by the Mexican Government to F. M. Aquilar, of Hermosillo, Mexico, for building a railroad from Hermosillo, in the State of Sonora, to Villa de Seris, 30 miles.

A company is about to be organized to take over and operate the San Gregorio R. R., which runs from Marfil to El Mineral de San Gregorio, 19 miles. It is proposed to build an extension to Gonzalez Junction, where connection will be made with the National of Mexico. Eusebio Rojas, of Guanajuato, Mexico, is said to be interested.

A concession has been granted by the Mexican Government to E. B. Tolman, of Chicago, for building and operating a railroad from Alamos, in the State of Sonora, to the port of Yadaros, 80 miles.

A company has been organized to build a railroad from Altata, in the State of Sinaloa, Mexico, to Topia, 100 miles. Jesus Alamada, of Altata, is said to be interested.

MIDLAND VALLEY.—Press reports state that this company has completed its line from Hartford, Ark., west to Bokoshe, Ind. T., 35 miles, and north to Greenwood, Ark., 20 miles. F. A. Molitor, Fort Smith, Ark., is Chief Engineer. (July 31, p. 562.)

MILLEN & SOUTHWESTERN.—An officer writes that this company has completed its line from Stillmore, Ga., to Vidalia, 21 miles. G. S. Burtchaell, Vidalia, Ga., is Chief Engineer.

MINNESOTA & NORTH WISCONSIN.—An officer writes that the following new mileage has been completed during the year: Nickerson, Minn., to Nemadji River, 15 miles; Scanlon to Adolph, 50 miles; Carolan south for a distance of five miles, and Nickerson to Pocket Lake, two miles.

MISSOURI, KANSAS & TEXAS.—An officer writes confirming the report that this company is building a branch line east of Carbon, Ind. T., to a coal mine about 18 miles.

NACOGDOCHES SOUTHEASTERN.—A charter has been granted to this company in Texas to build from Nacogdoches to a point on the Atoyac River, 35 miles. The company is capitalized at $50,000 and will have its headquarters at Nacogdoches. C. B. Hayward, Davenport, Iowa, is said to be one of the incorporators.

PAN-AMERICAN.—The Secretary of Oklahoma Territory has rechartered the Pan-American Railroad Co., with headquarters at Guthrie, and with $250,000,000 capital to build a line from Port Nelson, on Hudson Bay, in British America, to Argentine Republic. The total length is 10,000 miles and some of the road is in South America.

ROCHELLE & SOUTHERN (CHICAGO, MILWAUKEE & ST. PAUL).—Track laying is practically completed on this branch line of the Chicago, Milwaukee & St. Paul, and it is stated that the road will be opened for traffic early in the spring. The St. Paul has obtained trackage rights over the C., B. & Q. from Davis Junction, a station on the Council Bluffs Division 70 miles west of Chicago, to Steward. From there the company has built through Mendota to Seatonville, 40 miles. A chief purpose of the new line is to supply coal to the Chicago, Milwaukee & St. Paul. At present the company has to pay high transportation charges on coal brought over other roads. (Sept. 4, p. 642.)

ST. LOUIS, EL RENO & WESTERN.—Grading has been completed on this line from Guthrie to El Reno, 42 miles, and track has been laid as far as Lookridge, 22 miles. H. T. Genung, Guthrie, Okla., is Chief Engineer. (Sept. 25, p. 698.)

ST. LOUIS, BROWNSVILLE & MEXICO.—Surveys have been completed for this proposed line from Robstown, Texas, to the Rio Grande River, near Brownsville, 141 miles, with a branch line to Hidalgo, 57 miles. Grading has been completed on about 75 miles of the line, and it is stated that 30 miles of track will be laid by Jan. 1. F. G. Jonah, Corpus Christi, Texas, is Chief Engineer. (July 3, p. 502.)

SIERRA OF CALIFORNIA.—It is stated that work is now in progress on an extension of this line from Campbells, Cal., to Sugar Pine, 12 miles.

SOUTHERN.—An officer writes that the following lines have been completed during 1903: Spur from Rock Run, Ala., to mines, four miles; spur from Spring Garden, Ala., to mines of the Alabama-Georgia Iron Company, 4½ miles; spur from Cedar Bluff, Ala., to mines of Alabama Steel & Wire Company, five miles; Warrior Southern branch from Tidewater mines to Central City, 13.6 miles, and a spur from Mile-post 6, on the Roswell Branch, to Morgan's Falls, Ga., three miles. Work is now in progress on a branch line from Okolona, Miss., to Houston, 29 miles, and also on a branch line from Daley, Ala., for a distance of four miles.

STANDARD & HERNANDO.—This company has applied for a charter in Florida, to build from Standard to Hernando, 23 miles, with a branch line to a point on the Gulf of Mexico. G. F. Dittman, C. H. Lloyd and others, of Holder, Fla., are incorporators.

TALLAHATTA.—This company has completed its line from Meehan Junction, Miss., to Days Station, 12 miles. Work is now in progress on an extension from the end of the line to Battlefield, eight miles. S. K. Rounds, Meehan Junction, Miss., is interested.

TENNESSEE INDUSTRIAL R. R.—A charter has been granted this company in Tennessee, to build a railroad from a point on the Cumberland River, near the mouth of Harpeth River in Dickson County, southwest to Clifton, in Wayne County, 70 miles. J. D. Parish, W. M. Shipman, W. L. Cooke and others are incorporators.

TONOPAH.—Bids will be received by the Tonopah Mining Company, Butler, Nev., until Jan. 2, for building the company's railroad from Rhodes, Nev., to Tonopah, 60 miles. (Aug. 7, p. 580.)

GENERAL RAILROAD NEWS.

CHICAGO & ALTON.—The following official statement has been issued to the shareholders in this company: Holders of the preferred stock of the Chicago & Alton Railway Company are informed by Kuhn, Loeb & Co. that a large amount of that stock has been deposited with them, subject to an agreement authorizing the sale thereof on or before September 30 next, upon such terms and at such price as may be approved by a preferred stockholders' committee, consisting of John A. Stewart, Edward H. Harriman and John J. Mitchell. Holders of preferred stock who desire to participate in any sale which may be made under this agreement are requested to deposit their certificates at once with the bankers, who reserve the right to terminate the privilege at any time. Depositors will receive transferable receipts entitling them to a pro rata share of the net proceeds of any sale, and in case no sale is made before September 30, to the return of their stock without expense. From this statement it would appear that control of the road had been sold but no official confirmation of this fact has yet been made public. One of the members of Kuhn, Loeb & Co. is reported to have said: I think the circular is self-explanatory. Of course, a definite purchaser is in view, but it would serve no good purpose to say at present who it is.

GRAND TRUNK.—This company has deposited $5,000,000 of guaranteed stock as security for carrying out the agreement entered into during the last session of Parliament between the Canadian Government and the Grand Trunk Pacific.

GRAND TRUNK PACIFIC.—See Grand Trunk above.

IOWA CENTRAL.—Gross earnings of this company for the fiscal year ending June 30 were $2,405,543, a decrease of $137,807. Operating expenses were $1,885,274, a decrease of $140,575, leaving an increase in net earnings of $2,768. The decrease in gross earnings is due to a decrease in freight earnings on account of the poor crops during the past year, which were seriously damaged by excessive rainfall and early frosts. The decrease in operating expenses showed that the company has been able to cut down its maintenance charges owing to the fact that the road is now beginning to reflect the benefit from the large improvements which have been made during the past three years.

LAKE SHORE & MICHIGAN SOUTHERN.—A semi-annual dividend of 4 per cent. has been declared on the stock of this company, raising the rate to 8 per cent. per annum. This is an increase of one per cent. over the regular rate of 7 per cent. which has been paid since 1898.

NEW ORLEANS TERMINAL.—The property of the New Orleans Belt & Terminal Co. has been transferred to this company, and a mortgage has been filed on the property for $15,000,000 in favor of the Guaranty Trust Co. of New York. This transaction relates to the plans of the Southern Railway Co. and the 'Frisco system for joint terminals in New Orleans. See below.

NEW YORK & OTTAWA.—The sale of this road, which was advertised to take place at St. Regis Falls, N. Y., on Dec. 29, has been adjourned until June 22, 1904. H. W. Gays will continue in charge as receiver until that date.

NORFOLK & WESTERN.—Application has been made to the New York Stock Exchange to list $1,000,000 additional first consolidated mortgage 4 per cent. bonds due 1996 of the Norfolk & Western Railroad Co.

PHILADELPHIA, BALTIMORE & WASHINGTON.—Kuhn, Loeb & Co. are offering at 104½ and accrued interest the unsold portion of an issue of $10,000,000 first mortgage 4 per cent. 40-year gold bonds of this company. These bonds constitute a first mortgage on the lines of the company from Philadelphia to Baltimore, and after 1911 will also be a first mortgage on the rest of the line from Baltimore to Washington. (Nov. 6, p. 804.)

ST. LOUIS & SAN FRANCISCO.—Trackage agreement has been made whereby this company's trains will enter New Orleans over the Mobile & Ohio, which road is controlled by the Southern. The St. Louis & San Francisco will use the Mobile & Ohio tracks from Tupelo, Miss., to Meridian, 144 miles, and from there will pass over the New Orleans & Northeastern, a part of the Frisco system, to New Orleans. The St. Louis & San Francisco and the Southern are now making arrangements for building joint terminals in New Orleans.